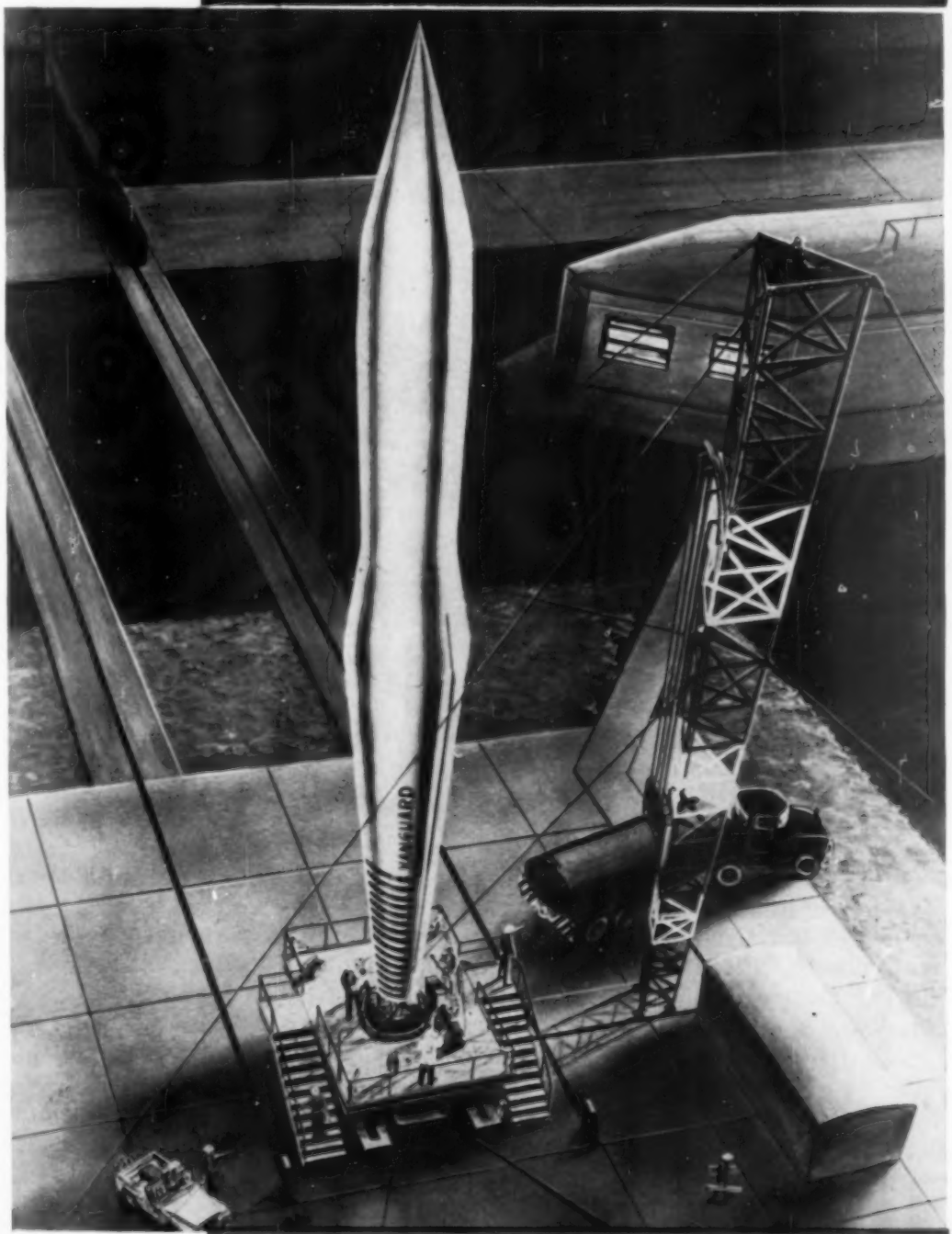
FEB 28 1958

FEBRUARY 1958

THE LIBRARY OF CONGRESS SERIAL RECORD
MAR 3 - 1958

PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING



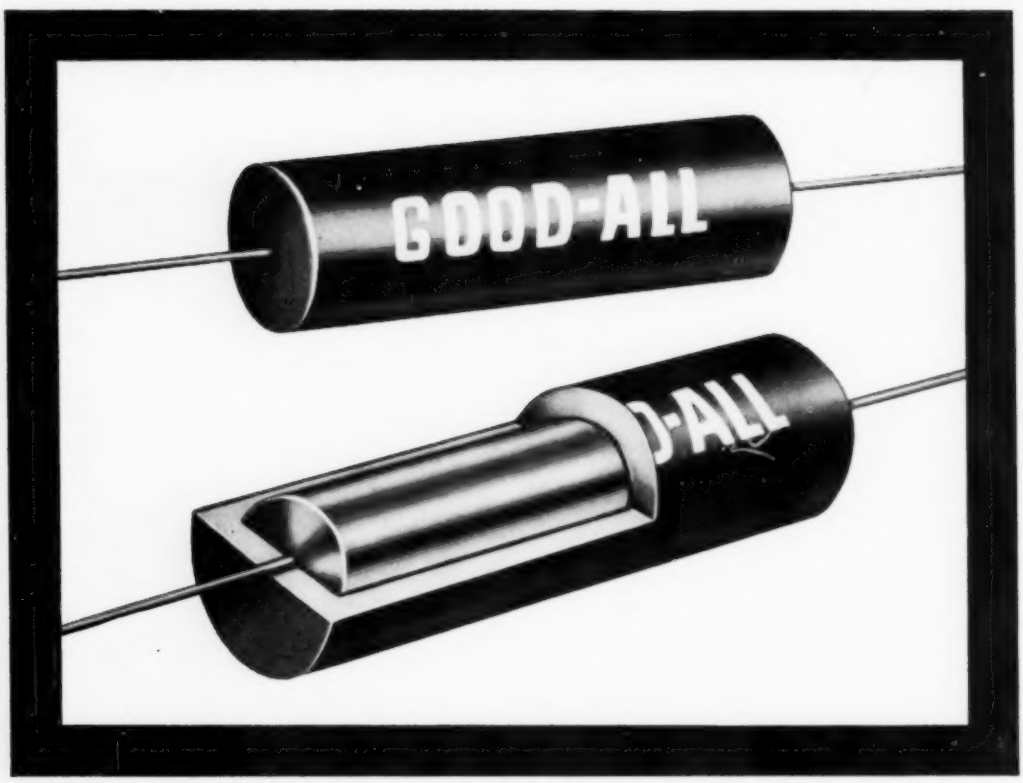
VANGUARD ROCKET WILL HAVE JETTISONIZABLE NOSE CONE SHELL OF REINFORCED PLASTIC

See Feature Story/page 142

A BILL BROTHERS PUBLICATION

EPON® RESIN does it!

Improved GOOD-ALL capacitors have low leakage, high stability—even in extremely humid climates



Here's how:

EPON RESIN is helping to set new standards of excellence in a line of 600 UE capacitors made by Good-All Electric Manufacturing Company, Ogallala, Nebraska.

Good-All reports that Epon resin offers superior moisture resistance . . . far better humidity protection than obtained with conventional molding materials. These capacitors offer rugged, trouble-free performance because Epon resin assures high dielectric strength, low leakage, great resistance to chemical and corrosive attack, and handsome appearance.

For molding . . . for potting . . . for laminating, sealing and encapsulating . . . Epon resins are preferred because they offer an almost ideal combination of electrical and physical properties.

• • •

Write for complete information on the use of Epon resins in protective enamels, tool and die materials, etched circuit laminates, transformer and motor sealing compounds.

SHELL CHEMICAL CORPORATION

CHEMICAL SALES DIVISION, 380 Madison Avenue, New York 17, New York

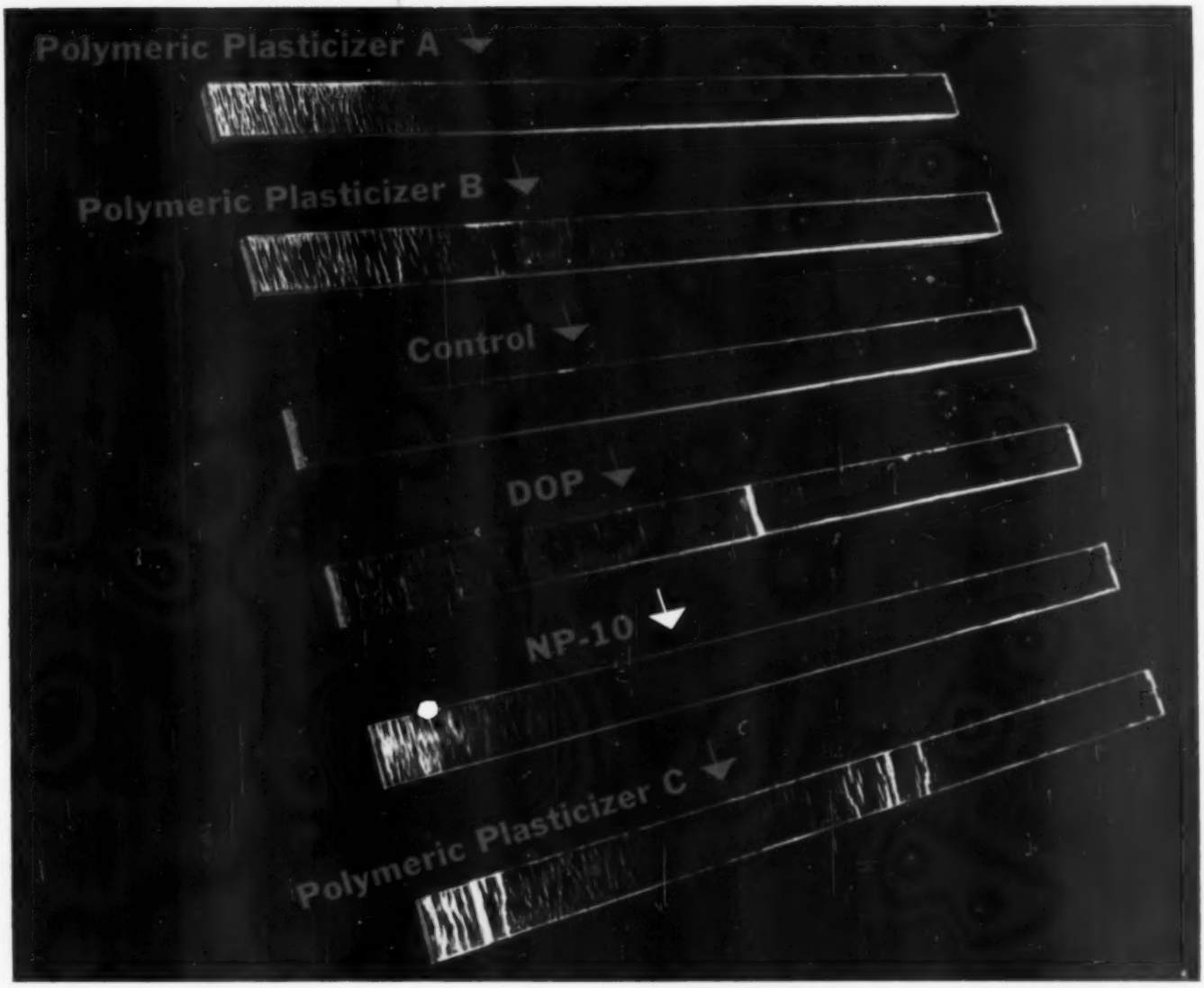
Atlanta • Boston • Chicago • Cleveland • Detroit • Houston • Los Angeles • Newark • New York • San Francisco • St. Louis

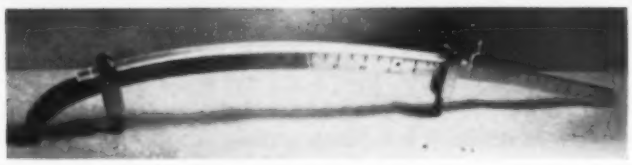
IN CANADA: Chemical Division, Shell Oil Company of Canada, Limited • Montreal • Toronto • Vancouver

SHELL

PLASTICS TECHNOLOGY, published monthly by PLASTICS TECHNOLOGY PUBLISHING CORP., a division of BILL BROTHERS PUBLISHING CORPORATION. Office of Publication, Third Street and Hunting Park Avenue, Philadelphia, Pa., with Editorial Executive Offices at 386 Fourth Avenue, New York 16, N. Y. Subscriptions in United States and possessions and Canada $5.00 per year. All other countries $10.00. Accepted as controlled circulation publication at Philadelphia, Pa. Copyright 1958 by Plastics Technology Publishing Corp. Please send changes of address to the New York office.

FEB 28 1958





Stress test of **vinyl plasticizers** shows

less polystyrene crazing with Eastman Polymeric Plasticizer NP-10

Crazing and staining of polystyrene surfaces in contact with compounded polyvinyl chloride can be virtually eliminated by using Eastman Polymeric Plasticizer NP-10.

In the test illustrated above carefully molded and cured polystyrene strips were subjected to external stress on an elliptical clamp. To magnify the effect on polystyrene resulting from its contact with plasticized vinyl compound, various plasticizers were poured directly on the strips and allowed to remain for 24 hours, or until fracture occurred.

The photograph shows the results and pointedly illustrates the relative inertness of Eastman Polymeric Plasticizer NP-10 on polystyrene surfaces.

Polymeric Plasticizer NP-10 exhibits permanence characteristics equal or superior to those of high-molecular-weight plasticizers, yet, being itself a compound of moderate molecular weight, blends in easily and rapidly. It is highly resistant to hydrolysis. Its loss from vinyl films to hydrocarbons, soapy water and activated charcoal is extremely low. It is odorless, tasteless, colorless, non-toxic and provides good low-temperature flexibility.

Eastman Polymeric Plasticizer NP-10 is an ideal primary plasticizer for vinyl applications such as refrigerator door gaskets, automotive trim... or wherever maximum permanence is essential.

Eastman CHEMICAL PRODUCTS, INC., KINGSPORT, TENNESSEE, subsidiary of Eastman Kodak Company

SALES OFFICES: Eastman Chemical Products, Inc., Kingsport, Tennessee; New York City; Framingham, Massachusetts; Cincinnati; Cleveland; Chicago; Houston; St. Louis. **West Coast: Wilson Meyer Co.,** San Francisco; Los Angeles; Portland; Salt Lake City; Seattle.

U.S.I.

Vol. III No. 1

POLYETHYLENE PROCESSING TIPS

PROCESSING CONDITIONS AFFECT STRESS-CRACK RESISTANCE OF POLYETHYLENE PRODUCTS

Most thermoplastic materials are subject in varying degrees to environmental stress-cracking . . . and polyethylene is no exception. Stress-crack failures may occur in polyethylene when the plastic is under high local stresses, either externally or internally applied, and in contact with soap, detergent or solvent.

Stress crack resistance depends on the resin used, and the processing conditions. The effect of polyethylene resin properties were discussed in the last issue of TIPS. This issue will be devoted to the effect of processing conditions.

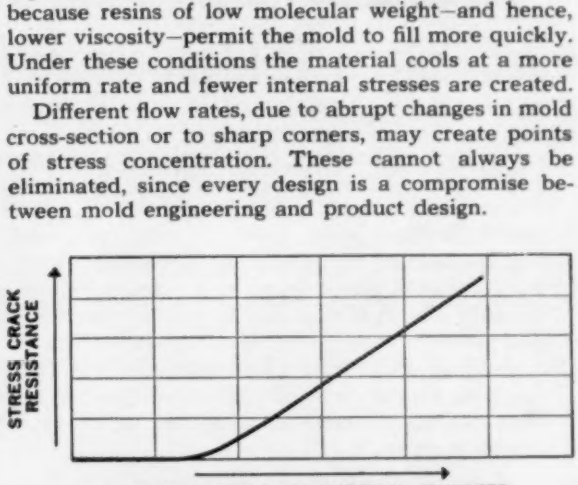
Apart from outside forces, there are, for a given polyethylene resin, two main causes of stress-cracking: locked-in stresses, and a high degree of molecular orientation. Locked-in stresses arise from uneven shrinkage during cooling. In molecular orientation, polyethylene molecules are comparable to iron filings in a magnetic field; they line up in force or stress patterns which, in effect, are stress concentrations along which fractures may occur.

Mold design affects stress cracking

To improve the stress-crack resistance of molded polyethylene, the molder should select his resin carefully on the basis of mold design, injection and mold temperatures, and, of course, the properties he wants in his end product.

Here, for example, is one way in which mold design can influence the choice of a resin: It is *generally* true that resins of higher molecular weight have relatively high stress-crack resistance. But in deep-draw molded items, or those with large cross-sections, resins of low molecular weight often yield a product with better stress-crack properties. This is because resins of low molecular weight—and hence, lower viscosity—permit the mold to fill more quickly. Under these conditions the material cools at a more uniform rate and fewer internal stresses are created.

Different flow rates, due to abrupt changes in mold cross-section or to sharp corners, may create points of stress concentration. These cannot always be eliminated, since every design is a compromise between mold engineering and product design.

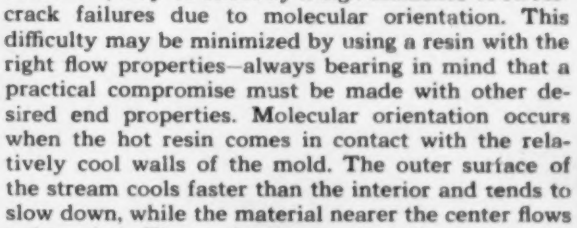


Stress crack resistance increases with higher stock temperatures in injection molding.

How Cold the Mold?

Higher production rates, made possible by running a cold mold, may be offset by a high incidence of stress-crack failures due to molecular orientation. This difficulty may be minimized by using a resin with the right flow properties—always bearing in mind that a practical compromise must be made with other desired end properties. Molecular orientation occurs when the hot resin comes in contact with the relatively cool walls of the mold. The outer surface of the stream cools faster than the interior and tends to slow down, while the material nearer the center flows unimpeded. The molecules tend to line up in the direction of flow.

This difference in cooling rates between the material at the periphery of the stream and its center also sets up internal stresses which induce stress-crack failures.



Molecular orientation is decreased with higher stock temperatures.

Mold Release Agents have some effect

Mold release agents may be of some benefit, as they tend to reduce the "drag" effect. However, caution must be used in their selection, since certain materials may induce stress cracking.

Compromise is often necessary

While no simple answer exists to the problem of stress-cracking in polyethylene products, resistance can usually be brought to a satisfactory level by choosing the best resin, making adjustments in molding temperatures, cooling rates and mold design. Since certain compromises must always be made, in selecting a resin and in processing techniques, processors can frequently use the services of a resin specialist. U.S.I.'s Technical Service Engineers are ready to discuss your processing problems, and to help in every way to solve them.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N.Y.
Branches in principal cities

JOHN W. HARTMAN
President

ROBERT B. CARTER
Vice President

FREDERICK C. KENDALL
Vice President

EDITORS

ARTHUR M. MERRILL
Editor

ROBERT G. SEAMAN
Consulting Editor

JAMES T. DUGAN
Associate Editor

CHARLES C. ORR
Assistant Editor

FLORENCE NEWMARK
Editorial Assistant

L. THAKAR
Foreign Editor

DR. JAY GOULD
Market Statistics

FRANCES Y. McHUGH
Production Manager

EDITORIAL ADVISORY BOARD

Materials
C. H. ADAMS
R. L. KNAPP
A. P. LANDALL
G. B. THAYER

Moldmaking
E. J. CSASZAR

Processing
SAUL BLITZ
H. T. DOUGLAS
G. S. LAAFF
J. H. WOODRUFF

Equipment
H. E. BUECKEN
E. H. JOHNSON
E. B. STRATTON
W. H. WILLERT

BUSINESS STAFF

ROBERT B. CARTER
Business Manager

LEE R. NOE
Eastern Representative
386 Fourth Avenue
New York 16, N. Y.
LExington 2-1760

WILLIAM T. BISSON
Mid-West Sales Manager
163 West Exchange Street, Room #7
Akron 8, Ohio
FRanklin 6-3434

C. E. LOVEJOY, JR.
Western Manager
333 N. Michigan Ave., Chicago 1, Ill.
STate 2-1266

ROBERT E. AHRENSDORF
Pacific Coast Representative
1140 Wilshire Blvd., Los Angeles 17
MAdison 9-2681
260 Kearny Street, San Francisco 8
EXbrook 7-0690

ALBERT R. WILSON
Circulation Manager

NBP BPA

Chairman of the Board, Philip Salisbury, President, John W. Hartman, Treasurer, Ralph L. Wilson, Vice Presidents, B. Brittain Wilson, C. E. Lovejoy, Jr., Wm. H. McCleary. Editorial and Executive Offices, 386 Fourth Ave., New York 16, N. Y. LExington 2-1760. Subscription Price: United States and Possessions and Canada, $5.00 per year. All other countries, $10.00. Single copies in the U. S., 50¢; elsewhere, 75¢. Other Bill Brothers Publications: In Industry: Rubber World. In Marketing Sales Management, Sales Meetings, Tide, Premium Practice. In Merchandising: Floor Covering Profits, Fast Food, Tires-TBA Merchandising. Members of Business Paper Audit of Circulations, Inc. and National Business Publications, Inc.

PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING

FEBRUARY 1958 VOLUME IV NUMBER 2

102 ARTICLE HIGHLIGHTS and PREVIEWS

127 **SOME ASPECTS OF THE STABILIZATION OF VINYL INSULATION**
J. G. Henricks and N. L. Cooperman
The importance of test temperature, lubricants, plasticizers, fillers, stabilizer dispersion, characteristics, processing temperature, and weathering on volume resistivity.

131 **EPOXY INSERTS FOR HONEYCOMB STRUCTURE**

132 **MEASURING THE ABRASION RESISTANCE OF PLASTIC LENSES FOR SUNGLASSES** *P. M. Kamath and H. O. Buzzell*
Results of laboratory tests, using a new type of abrader, give good correlation with field tests for comparing different plastic lens coatings.

137 **GUEST EDITORIAL: LET'S SELL THERMOSETS** *Paul E. Fina*

138 **A CONTROL PROGRAM FOR EPOXY-CAUSED DERMATITIS**
J. A. Stifter
The hazards and causes of irritant and allergic dermatitis are discussed, and an effective plant control program is presented.

142 **PLASTIC NOSE TO GUARD U. S. SATELLITE IN FLIGHT**

143 **EVALUATING EPOXY RESIN DEGRADATION SYSTEMS**
W. G. Murray and G. A. Stein
A test method is described that gives duplicable measurements of the effects of various exposure media on resins with different curing systems.

ADVANCES IN THE TECHNOLOGY OF PLASTICS:

149 **DEVELOPMENTS IN PLASTIC MATERIALS—1957** *Gordon B. Thayer*

152 **VALVE GATING INJECTION MOLDING**

FEATURE DEPARTMENTS

102	Letters to the Editor	162	New Materials
111	Editorial	166	New Equipment
119	News in Brief	169	Plastics Applications
153	News of the Societies	173	New Literature
186	Calendar of Coming Events	175	Book Reviews
155	News of Industry	177	Abstracts of Important Articles
159	Names in the News	182	Patent Digest
161	News from Abroad	187	Resins: Production & Sales

103 Quote . . . Unquote

PUBLISHED MONTHLY BY

Plastics Technology Publishing Corp., a Division of

BILL BROTHERS PUBLISHING CORPORATION
386 FOURTH AVENUE, NEW YORK 16, N. Y.

The opinions expressed by our contributors do not necessarily reflect those of our editors

Cover photo: courtesy of Raybestos-Manhattan, Inc.

Letters to the Editor

Article Highlights

Some Aspects of the Stabilization of Vinyl Insulation. (p 127)
Test results are given to show the importance and value of such factors as test temperature, lubricants, plasticizers, fillers, stabilizer dispersion, processing temperature, and weathering on the volume-resistivity electrical properties of compounded vinyl insulation.

Measuring the Abrasion Resistance of Plastic Lenses for Sunglasses. (p. 132)
Results of laboratory tests show the value and usefulness of a new type of abrader for measuring abrasion resistance. The results show good correlation with field tests when comparing different lens coatings for plastic lenses, with consequent savings in time, convenience, accuracy and precision of test results.

A Control Program for Epoxy-Caused Dermatitis. (p. 138)
After a detailed discussion of epoxy dermatitis, both irritant and allergic types, and their hazards and causes, an effective plant program is presented to control the problem. This program utilizes good company housekeeping and proper ventilation, in conjunction with personal worker cleanliness, and use of effective barrier creams and protective clothing.

Evaluating Epoxy Resin Degradation Systems. (p. 143)
Results of tests are given for three resin systems to determine the effects of exposure media on cast resin and pipe samples used in the tests. The cast resin samples absorb the media, while the pipe samples decompose and show losses in weight. Further work is continuing on this program.

Previews

The following articles will be published in the March issue:

The Thirty Years of Plastics Impact Testing—Part I. R. F. Westover, Member of technical staff, Bell Telephone Laboratories, Murray Hill, N. J.

Arc Resistance of Epoxies. John Delmonte, gen. mgr., Furane Plastics, Inc., Los Angeles, Calif.

Cutting Production Costs and Time with Epoxy Resin Press Dies. J. J. Mele, Grumman Aircraft Engineering Corp., Bethpage, N. Y.

Importance of Fabrication on the Properties of Silicone-Glass Laminates. E. C. Elliott, group leader, and K. P. Hoffman, supervisor, Resin Section, Prod. Engrng. Labs., Dow Corning Corp., Midland, Mich.

Wants Sources of Supply

Dear Sir:

Please advise us of several sources of supply of plastic plugs or caps suitable for closing ⅝-inch holes on plugs. We pack Ink-Solve "30" and Solv-O in metal cans, but would like to make them adaptable as shaker-type dispensers. They would be displayed on retail counters, so must be acceptable to the retailers and to the customer.

W. E. Schultz, Pres.,
Schultz Laboratories
Boone, Iowa

(Can our readers help?—Editor)

• • •

Wants Fabrication Articles

We agree wholeheartedly with G. E. LaCaven in his letter to you published in the November issue (page 860). Information on the plastics fabrication level is vitally needed. We would welcome articles on fabrication techniques.

M. Rosenthal, Manager,
Pioneer Valley Plastics Co.
Chicopee, Massachusetts

• • •

Liked November Editorial

Dear Sir:

Congratulations on your editorial ("Don't stand still, keep growing") in the November issue.

As producers of phenolics for the compression field, we have a vital interest. Not all molders are "sitting in defeat awaiting the end." Many are extremely aggressive and busy, and here at Durez we do not share the pessimistic attitude of the few.

There is ample opportunity for growth in this phase of the plastics industry, but it will not grow without hard constructive selling.

A. W. Hanmer, Jr., Gen. Sales Mgr.,
Durez Plastics Division,
Hooker Electrochemical Co.
North Tonawanda, N. Y.

• • •

Translucent Plastic Plates

Dear Sir:

Could you inform me who manufactures translucent plastic plates of about ½-inch thickness in various bright colors? The plastic should not deteriorate under sunshine and weather.

E. L. Meyer
Birmingham, Mich.

(Any suggestions from our readers will be transmitted to Mr. Meyer.—Editor)

• • •

Estimating Cure Times

Dear Sir:

This company uses hand transfer, semi-automatic transfer, and compression molding equipment in the manufacture of small parts from thermosetting plastic materials.

From our own experience and from the plastics molding literature, we have learned that the usual practice to establish polymerization or "cure" time is by the use of trial-and-error methods.

We would be pleased to learn if there have been any successful approaches to predetermine this time by gathering and plotting statistical data. At present, we are engaged in time-study work in our Molding Department. It would be helpful to learn if anyone else has had any success in plotting observed polymerization time against volume of material used, area, thickness of the mold and sprue, temperature, or other factor, and is using this data as a guide in pre-determining polymerization time for related parts.

Undoubtedly someone in the field must have reached a solution to this problem. We would appreciate receiving any information you can furnish.

Fred Taylor
Amphenol Electronics Corp.
Chicago, Illinois

(Can anyone provide Mr. Taylor with a practical answer?—Editor)

We invite letters from our readers for publication in these columns. Such letters may be of comment or criticism, requests for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation, and address.

A letter will not be printed if publication is not desired by the sender.

Letters requesting information on technical or engineering problems will be printed to elicit replies by the readers, either directly or through these columns. Upon request the identities of such "problem" letters will not be divulged.

"Quote . . . Unquote"

Importance of Packaging in Plastics

"In the giant plastics industry, packaging takes only a relatively small share of the total production, yet (in 1956) the consumption of these plastic packaging films which were only in their experimental stages 10 years ago amounted to 97,000 tons. Polyethylene is one of the most spectacularly successful of these, because of its many fine qualities and relatively low cost. Produce packers have learned that printed polyethylene packaging has increased their marketing period by weeks—protecting and preserving the contents while identifying the grower or packer. Because of its low temperature durability and moisture protection, this film is finding growing use in frozen-food packaging. Polyethylene is only one. The creative ingenuity of the chemical industry in this area of new flexible films is proving most productive.

"The economists agree that packaging will continue to grow. The forecasters say that cellophane production will grow from 175,000 tons (in 1957) to 350,000 tons in 1975; that aluminum, 45,000 tons this year, will amount to 175,000 tons in 1975; that new glass containers will increase from 19-billions to 30-billions, a growth of 60%; and that paper and paperboard will enjoy a 45% growth, while metal can production will be 40% greater by 1975."

H. R. Woodman, Pres.
Interchemical Corp.
New York, New York

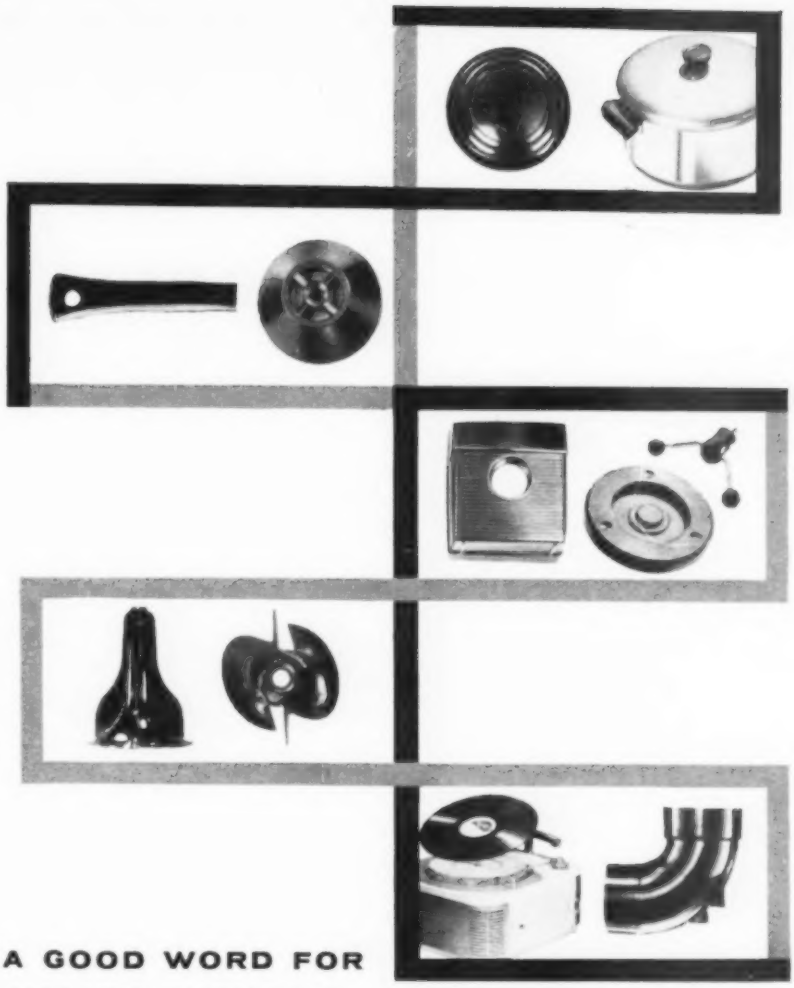
• • •

Reinforced Plastics in Trucks

"We now have several hundred plastic tanks in sizes up to 34-foot trailers hauling milk and other liquids in every part of the United States. Some of these units have been in operation for as long as three years, and our experience has actually been much more gratifying than even the most optimistic of us could have expected. One of the most encouraging aspects of the field performance of the plastic units is the tremendous strength properties which they display when involved in serious accidents.

"We have been very much encouraged with the ease with which plastic structures such as tanks and bodies can be repaired, restoring original appearance and strength by means of a relatively simple patching process whereby resin-saturated Fiberglas is applied to the damaged area. Our Service Department feels that . . . repairs to plastic equipment can be made much more simply, with less skilled workmen, faster, and at less expense than is necessary when we repair one of our steel tanks."

K. C. Sanders
The Heil Co.
Milwaukee, Wisc.



A GOOD WORD FOR
QUALITY PHENOLIC MOLDING COMPOUNDS

IN THEIR WIDEST APPLICATION IS

PLENCO

. . . a good word, too, for dependable counsel. Whether you take our advice or not, you can't help but profit from your consultation with Plenco's problem-solving specialists. And, in production, you can't help but benefit from the wide-ranging knowledge with which these modern molding materials are formulated and the precision with which they are produced.

Does phenolics have the answer for you? Then, chances are that Plenco compounds, in their exceptional variety, versatility and quality-controlled uniformity, can provide it. We invite you to let us demonstrate that.

P
PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and coating resins.

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin

For clearer clears, for brighter bright colors in vinyl film and sheeting...

New "Dutch Boy" Stabilizers

"Dutch Boy" research has done it again.

This time with two *new* stabilizers, outstanding for:

① clarity
② economy
③ easy use

One of these new "Dutch Boy" stabilizers, Flomax* 25 is a barium-cadmium organic. It's the one to give clears, vivid blacks, or colored translucents extraordinary heat and light stability. It contributes extremely high resistance to yellowing and to plateout.

The other, "Dutch Boy" Nalzin*, is an equally remarkable zinc organic co-stabilizer. When stain resistance is a must, Nalzin replaces a portion of the barium-cadmium organic.

Both of these stabilizers protect clarity and color during processing. Both prolong these values during product use.

Economical to Use

In cost, in efficiency, both Flomax 25 and NALZIN are the improvements you've been looking for.

They're easy to incorporate, as well . . . liquid, miscible in and compatible with common plasticizers and solvents, ideal for calendered resins.

If you make stocks for shower curtains, tablecloths, luggage, upholstery, pocketbooks and the like, get a rundown on Flomax 25 and Nalzin. And on four other "Dutch Boy" non-lead Stabilizers for stocks of this type. Write for the new "Dutch Boy" Stabilizer Handbook.

*Trademark

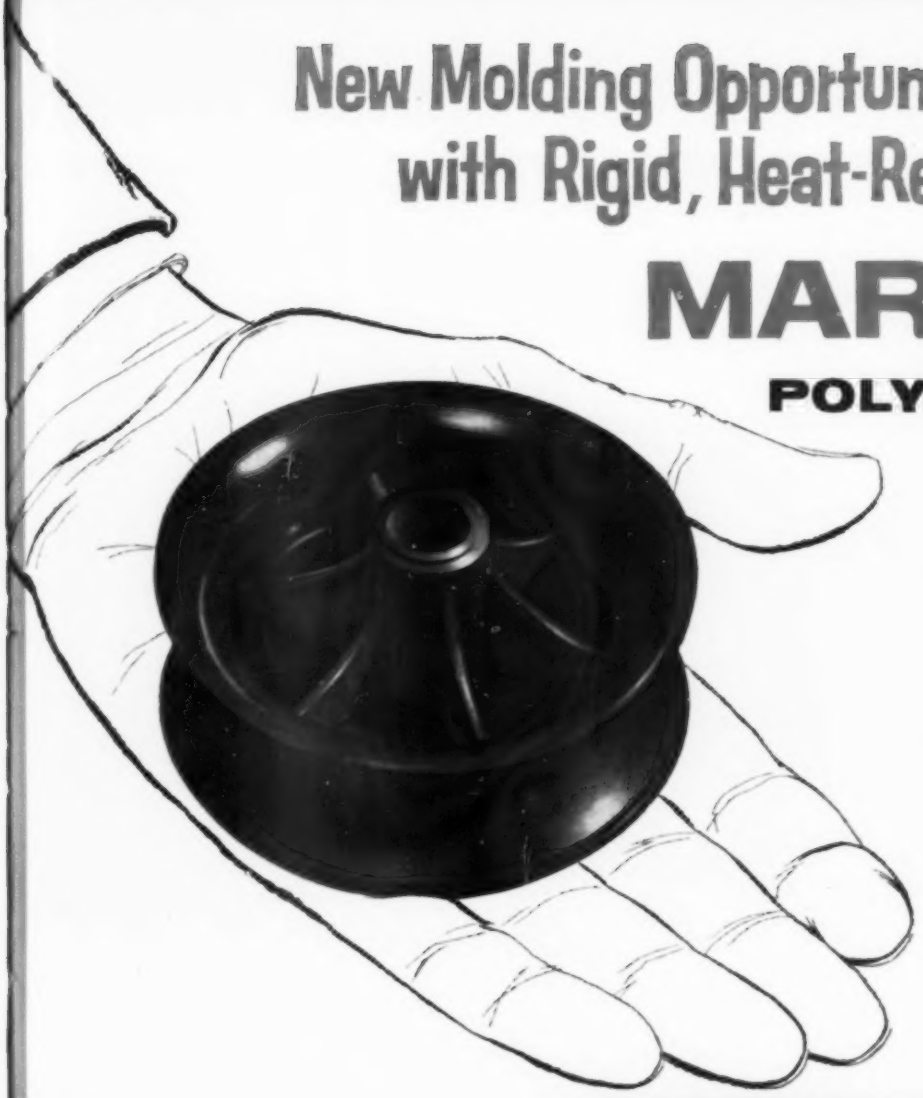
Dutch Boy® CHEMICALS

NATIONAL LEAD COMPANY
111 Broadway, New York 6, N. Y.
In Canada: CANADIAN TITANIUM PIGMENTS LIMITED
630 Dorchester Street, West, Montreal

New Molding Opportunities with Rigid, Heat-Resistant

MARLEX* 50

POLYETHYLENE



MARLEX 50 polyethylene is the preferred molding resin for a wide variety of heavy-duty industrial uses . . . wheels, corrosion-proof pump impellers, low-load gears, bearings and other mechanical components . . . glossy, colorful appliance housings, pipe thread protectors . . . and many other die-cast items requiring a low-cost, tough, abrasion-resistant plastic that is chemically inert.

New Sales Service Lab at Bartlesville is completely equipped with latest commercial processing machinery and research apparatus. Phillips experienced technical service staff will assist you in developing new products and processes using MARLEX plastics. Please make arrangements through your local MARLEX sales representative. Meanwhile, for complete data on MARLEX 50, send for our latest illustrated technical brochure.

Ease of extrusion, low permeability, chemical resistance and rigidity of MARLEX 50 plastic make it ideal for blow molding many types of food and drug bottles, squeeze bottles and aerosols. Its stiffness permits reductions in wall thickness with consequent savings of resin. Conventional processing techniques produce high-quality blown products with glossy surfaces and minimum internal stress.

Toys and housewares are a natural for this unbreakable, heat-resistant, nontoxic material. Its high tensile and impact strength and lack of brittleness at extremely low temperatures suggest many new applications unsuited to conventional polyethylenes. Molders can profit from the fact that form stability at higher temperatures frequently permits quicker mold ejection and shorter cycle times.

*MARLEX is a trademark for Phillips family of olefin polymers.

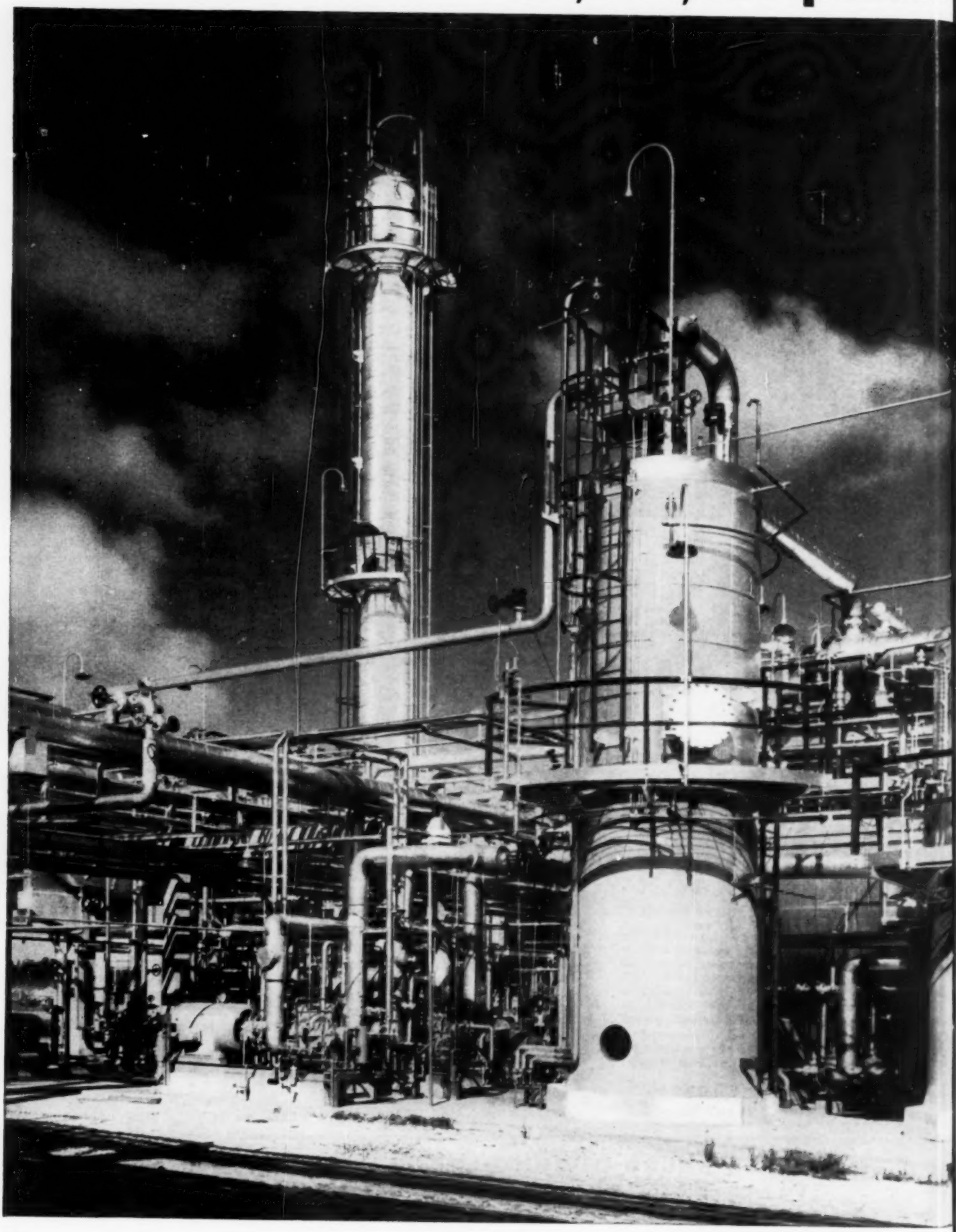
PLASTICS SALES DIVISION, PHILLIPS CHEMICAL COMPANY

A Subsidiary of Phillips Petroleum Company, Bartlesville, Oklahoma

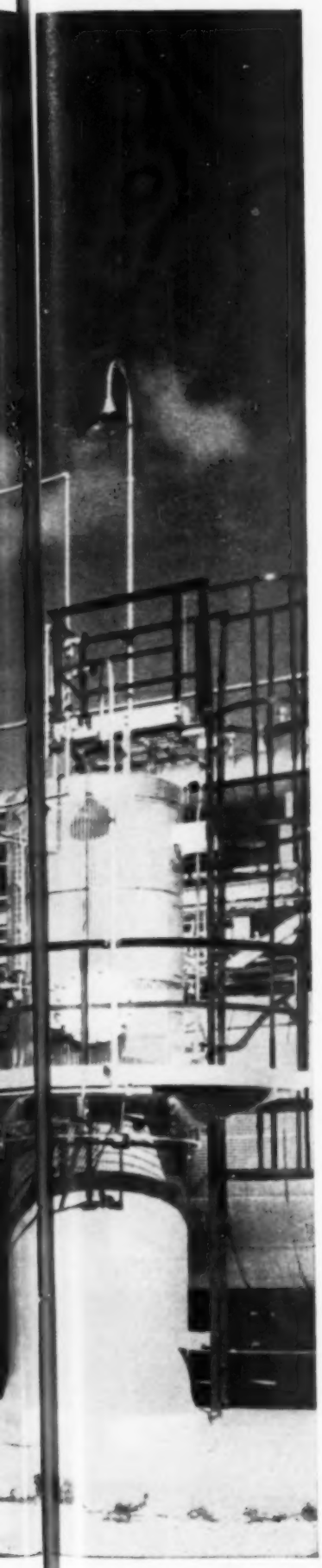
DISTRICT OFFICES

NEW ENGLAND	NEW YORK	AKRON	CHICAGO	WESTERN	SOUTHERN & FOREIGN
322 Waterman Avenue, East Providence 14, R. I. GEneva 4-7600	80 Broadway, Suite 4300 New York 5, N. Y. Digby 4-3480	318 Water Street, Akron 8, Ohio FRanklin 6-4126	111 S. York Street, Elmhurst, Ill. TErrace 4-6600	330 Security Bldg., Pasadena, Calif. RYan 1-6997	Adams Building, Bartlesville, Oklahoma Bartlesville 6600, Ext. 8108

W. R. Grace & Co.'s 50,000,000 pound



high density polyethylene plant now in commercial production



* Multi-million dollar facility to produce GREX, the new high strength plastic resin.

* W. R. Grace & Co., Polymer Chemicals Division, reports GREX substantially improved over other resins, promising new horizons for plastics.

W. R. Grace & Co., Polymer Chemicals Division, recently put into commercial operation its multi-million dollar plant at Baton Rouge, Louisiana. First product is GREX, brand-new high density polyethylene. 50,000,000 pound annual capacity makes this the world's largest plant of its kind to come on stream as an integrated operating unit.

For several months, plastic fabricators have been testing and evaluating quantities of GREX with excellent results. Now, with this new plant, GREX is immediately available for large-scale commercial application.

"NEW CHEMICAL PRODUCT"

Officials of W. R. Grace & Co. express enthusiasm over the possibilities GREX offers the plastics industry, characterizing GREX as "plastic of tomorrow" and "new concept in plastics." According to Mr. T. T. Miller, Polymer President, "GREX differs from other plastics to such a degree, it merits being called a new chemical product."

Exceptional toughness and resistance to extremes of heat and cold are the outstanding property improvements to be found in GREX. Resistance to chemicals, impermeability to moisture vapor, good electrical characteristics, and rigidity are other property areas in which GREX excels. This new material can be injection molded, extruded, compression molded, blow molded, calendered, vacuum formed and foamed. It can be machined, punched, drilled, welded and heat sealed.

VERSATILITY CITED

What does this mean to the plastics industry? "GREX," explains Mr. Miller, "gives the fabricator a quality resin with outstanding versatility. GREX permits him to convert ideas for completely new plastic products into selling items. And by switching to GREX, he can upgrade his present plastic products.

The Polymer Chemicals Division laboratories at Clifton, N. J. include a full line of commercial size plastic fabrication equipment for development purposes. Here, a trained and seasoned technical staff works with Grace customers to learn what plastic products can be better-made with GREX, to uncover new uses for plastics, and to discover more efficient fabrication techniques. The Grace technical staff have also proved their ability to help a customer in his own plant.

OFFER MARKETING SUPPORT

The makers of GREX extend this support to the marketing of GREX products as well. Grace merchandising experts will work with fabricators, and through them, with customers, to help search out their most promising markets. Then, Grace will collaborate on sales and promotion planning to achieve increased sales.

Mr. Miller emphasizes that GREX is expected to make substantial gains in markets now dominated by other materials like glass, wood, metal, offering the plastics industry unlimited potential. There is virtually no business that cannot put GREX to good use.

INQUIRIES INVITED

"GREX is a new product with great promise," he declares. "We believe in it to the tune of over $20 million. But more important, we at Grace are willing to work to prove out GREX in actual applications. Anyone interested in GREX has only to write or phone us at our Clifton offices—225 Allwood Road, Clifton, New Jersey, GRegory 2-6000. His inquiry will receive our immediate attention and he can be sure of full cooperation from our entire organization."

Admiral
American Optical Company
Ansco
Arvin
AUTOMATIC ELECTRIC
A member of the General Telephone System
One of America's great communications systems
GENERAL SYSTEM
BISSELL
BULOVA
Elizabeth Arden
Emerson
FORD MOTOR COMPANY
Maybelline
MONROE
PAPER MATE
PHILCO
Scripto
WEAREVER
PENS AND PENCILS
WESTCLOX
Western Electric
ZENITH

FAMOUS NAMES *use* FORTICEL

Celanese propionate molding material

These trademarks have become identified in the consumer's mind with dependable quality and performance.

Since its introduction, Forticel Plastic, too, has become identified with quality and performance . . . the quality and performance it permits manufacturers to maintain in their products.

That's why Celanese Forticel has become the natural choice of the nationally-famous companies these trademarks represent.

Quality and production efficiency are among the important advantages Forticel Plastic offers the manufacturer serving industry and the public.

Celanese Corporation of America, Plastics Division, Newark 2, N. J.
Canadian Affiliate: Canadian Chemical Co., Limited, Montreal, Toronto, Vancouver.
Export Sales: Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Avenue, New York 16, N. Y.

Celanese® Forticel®

Forticel . . . a Celanese plastic

TYPICAL PHYSICAL PROPERTIES OF FORTICEL

Flow temperature: (°C.) (A.S.T.M.)	D569-48	167–178
Specific gravity	D176-42T	1.18–1.21
Tensile properties:		
Yield (p.s.i.)	D638-52T	3380–5020
Break (p.s.i.)	D638-52T	3470–5240
Elongation (%)	D638-52T	56–66
Flexural properties:		
Flexural strength (p.s.i. at break)	D790-49T	6400–8500
Flexural modulus (10^5 p.s.i.)	D790-49T	0.23–0.30
Rockwell hardness: (R scale)	D785-51	62–94
Izod impact: (ft. lb./in. notch)	D256-43T	2.7–11.0
Heat distortion: (°C.)	D648-45T	59–70
Water absorption:		
% sol. lost	D570-42	0.00–0.06
% moisture gain	D570-42	1.5–1.8
% water absorption	D570-42	1.6–1.8

Celanese Corporation of America, Plastics Division
Dept. 184-B, 744 Broad Street, Newark 2, N. J.

Please send me New Product Bulletin NP-16 on Forticel Plastic.

NAME_____

TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

SECOND OF A SERIES

Chemical Division GENERAL THE GENERAL TIRE & RUBBER CO VYGEN

THE GENERAL TIRE & RUBBER COMPANY
CHEMICAL DIVISION • AKRON, OHIO

INTER-OFFICE MEMORANDUM

FROM: Product Chemist

TO: Chief Chemist

SUBJECT: VYGEN PVC RESINS

As you requested, we have evaluated the samples of General Tire's Vygen Resins in our lab. Generally speaking, these resins have outstanding heat stability and are free of gelled particles. They are also very good for clarity. Following are specific comments on each resin:

VYGEN 105—The flow properties are quite good, but the thing which impresses me most is its very fine heat stability. When injection molded in the lab, the parts had very good surface gloss. We also evaluated it in our laboratory extruder – again the heat stability was very good, and the surface was glossy and free of imperfections. This resin should be given an extended test in the plant to get a better idea of its heat stability under operating conditions.

VYGEN 110—This resin has excellent heat stability. I recommend it be put into use immediately in the plant on light color jobs where color drift has been a problem.

VYGEN 120—The heat stability of this resin is the best of any we have ever evaluated. We also tried it in a lab dry-blender with polymeric plasticizers, finding it to be completely satisfactory in this use. Extrusions of Vygen 120 were excellent, even with the formulas containing polymeric plasticizers. This one is ready for plant runs.

VYGEN 161—We made up a pigment-plasticizer-resin masterbatch, as suggested, and found the masterbatch to be very dry. This looks like a good answer to how to handle colors in the plant, since it is so much easier to handle than paste or dry pigments. Also, it is much easier to weigh accurately, and will permit much better color control

Charts, graphs, and samples of evaluation work are attached.

R C Carnegie

Product Chemist

PLASTICS TECHNOLOGY

FEBRUARY, 1958

EDITORIAL: So It Still Is a Secret?

In its evolution, every new industry goes through a period of growth wherein its techniques are classified as arts or secrets. In this period of industrial childhood, technical progress is slow and all developments made are considered to be the developers' secrets.

In this childhood stage, most of the processing companies in that industry spend a good deal of time and effort in guarding their own precious secrets and, conversely, in trying to ascertain the secrets of their competitors. During this period of secrecy, the only technical information made available to all is that gathered by the suppliers of materials and equipment for that industry.

•

As the new industry continues to mature, a more enlightened attitude toward this secret information becomes evident. To a major extent, this new attitude can be traced to the technical men of that industry. With their relatively free interchange of ideas and information at meetings of the industry's professional societies, the technical men soon recognize that many of their company's most cherished secrets are only bits of technology that are being employed quite universally throughout that industry.

This discovery presents the technical men with the difficult task of trying to convince management of the true state of affairs in the growing industry. This period of convincing management is the industry's stage of adolescence—difficult, often painful, and usually lengthy in duration.

The plastics industry is now in adolescence. The technologists recognize that many of their company's most guarded secrets are not really secret at all, but management is not convinced. From our position as a sounding board for the dissemination of technical information on plastics, we are all too aware of the situation.

Time and again, we have been either shown or informed of a specific development by a company which that firm considers to be its secret. While respecting that company's confidence, we still are painfully aware that this same development has been made by at least one other firm in the field! Yet each of these firms zealously guards its "secret!"

These unconvinced managements are quite vociferous in asking that we publish detailed articles of the how-to-do-it type on plastics processing, but do not realize the incongruity of their steadfast refusal to write on their own processing developments; these are secret!

•

This explains why true engineering articles on plastics processing techniques are the most difficult to obtain, and why published articles of this type usually have sections that are either sketchy or obvious by their omission.

Of course, we neither ask nor expect processors to divulge developments that give them an economic advantage over their competitors. Instead, we urge management to make a true evaluation of their "secrets."

Arthur M. Merrill

Editor

This is a reprint of an editorial originally published in our March 1956 issue. Have conditions changed?

Announcing...*Monsanto's improved film resin for industrial packaging and barrier uses*

MONSANTO POLYETHYLENE 706

Monsanto Polyethylene 706 resin has been developed specifically for industrial packaging and barrier uses. An unmodified resin containing no additives, 706 meets the most exacting requirements for industrial film applications regardless of the fabricated product—from toughness and uniformity of appearance to ease of handling on fabricating machines and openability. This outstanding new resin is chemically inert and possesses carefully controlled physical properties.

Already performing for many important film extruders, this newest in the expanding Monsanto Polyethylene resin series is now available in full commercial quantities. For complete data, and other information, write Monsanto Chemical Company, Plastics Division, Room 1771, Springfield 2, Mass.

Monsanto

Tube Openability
"Excellent"... over a wide range of gauges and extrusion speeds.

Extrudability
"Maximum performance" ... can be drawn to a 0.5 mil gauge.

Appearance
"Highly uniform translucence"... uniform fine grain structure.

Toughness
"Superior"... shock-impact strength maintained at thin gauges with normal blow-up ratios.

Keep quality up with higher loadings of Super Multifex®

Actual use and rugged tests show vinyl compounders can profitably use Super Multifex in loadings as high as 70%. Even at this healthy proportion, DIAMOND'S calcium carbonate helps vinyl resist abrasion more successfully than ground limestone.

This ultra-fine particle filler produces less whitening when your vinyl is bent or scratched. SUPER MULTIFEX has a very uniform particle size — about 0.03 micron — and a double coating with two different agents to aid its dispersion.

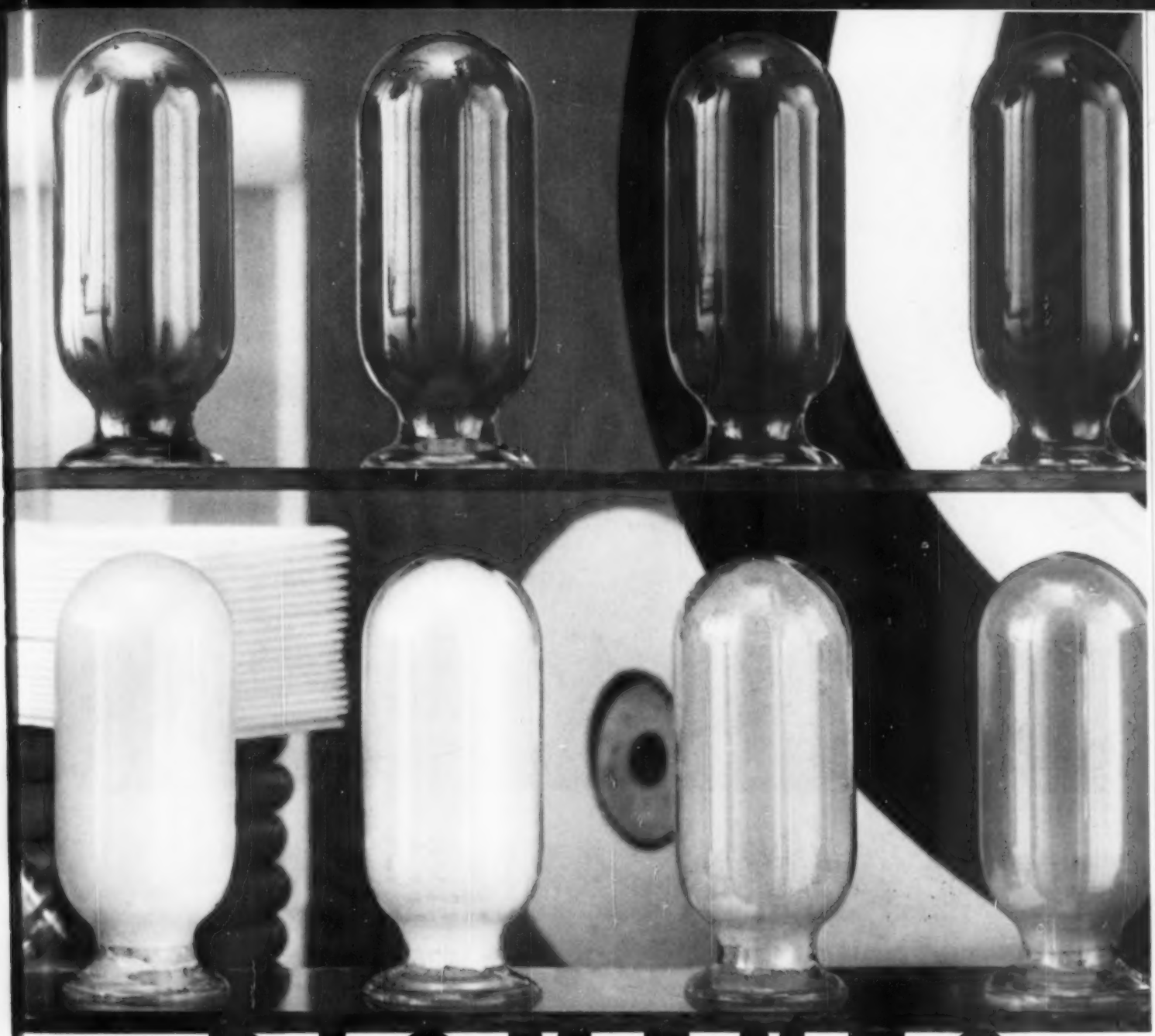
Using high loadings of SUPER MULTIFEX, you can maintain your present quality standards — at less cost. Or boost quality at no extra cost.

Your nearby DIAMOND sales office can show you money-saving formulas and detailed cost comparisons. Or write to DIAMOND ALKALI COMPANY, 300 Union Commerce Building, Cleveland 14, Ohio.

Diamond Chemicals

Sales offices: New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis, Houston.

Diamond distributors: Carmona & Hawxhurst, San Francisco; Dorsett & Jackson, Los Angeles; Van Waters and Rogers, Inc., Seattle and Portland, U. S. A.; Harrisons & Crosfield (Canada) Ltd.



PIGMENTS

How to get the whiteness or color brightness you demand for your plastic products

Glidden pigments are the answer. New *Zopaque* Titanium Dioxide imparts greater lasting whiteness, permits brighter, cleaner tints. Finer, more uniform particles disperse much faster, more easily than ordinary pigments. Millions of tiny crystals scatter light like diamonds, assure highest opacity.

Non-fading, non-bleeding Glidden *Cadmolith* (cadmium-selenium) Reds and Yellows plus new *Mercadmolith* (cadmium-mercury) Reds provide everything you need to give your products maximum color appeal. They are soft, easy to grind, insoluble in all vehicles, and high in heat resistance.

Be sure to specify Glidden—a leading supplier of finest pigments to industry.

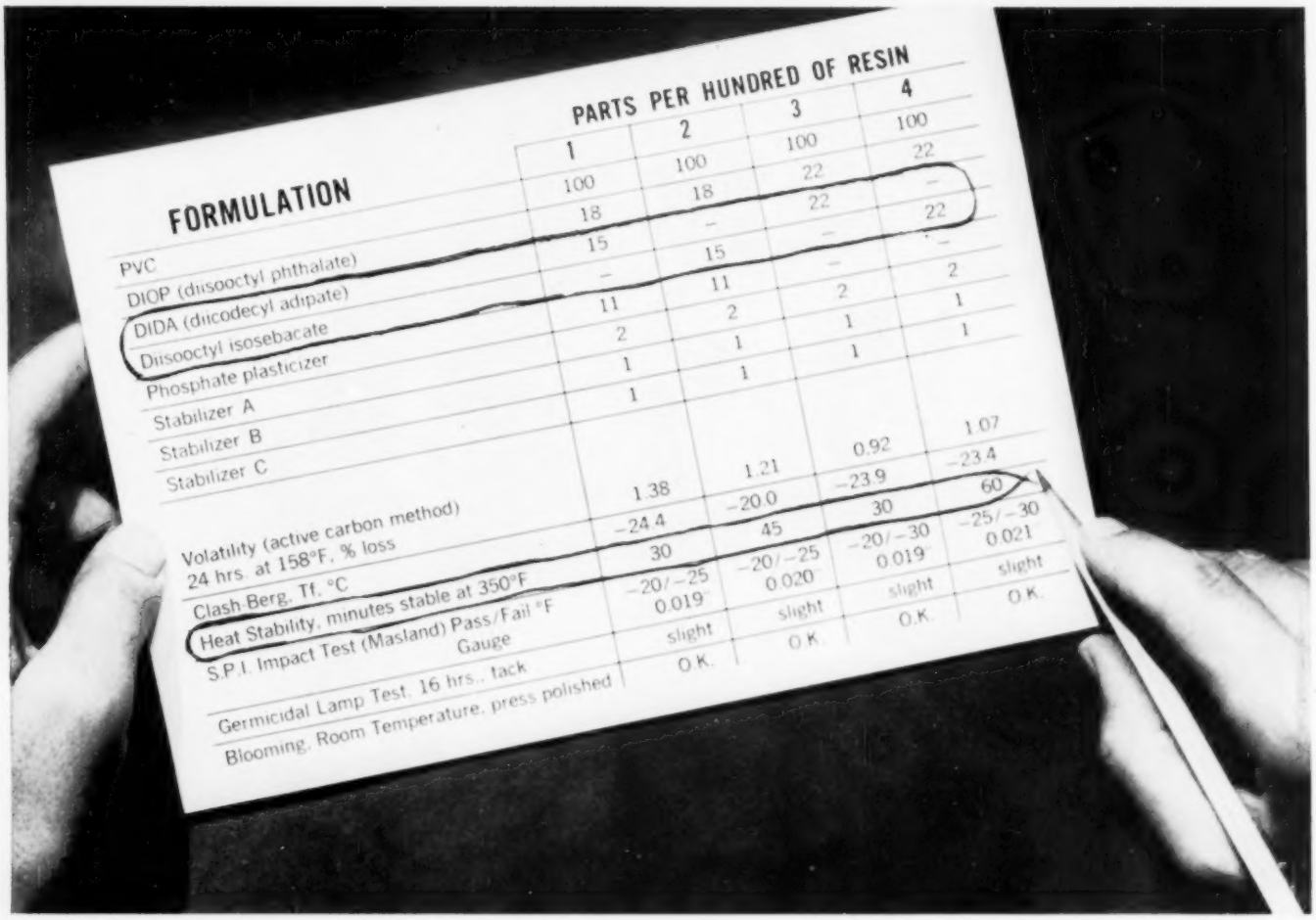
By the makers of Sunolith Lithopones . . . Euston White Lead . . . Resistox Copper Pigments

THE GLIDDEN COMPANY

Chemicals · Pigments · Metals Division

Baltimore, Maryland • Collinsville, Illinois • Hammond, Indiana • Scranton, Pa.

QUALITY Glidden PRODUCTS


FORMULATION
PARTS PER HUNDRED OF RESIN
1 2 3 4
PVC 100 100 100 100
DIOP (diisooctyl phthalate) 18 18 22 22
DIDA (dicodecyl adipate) 15 – – –
Diisooctyl isosebacate – 15 22 22
Phosphate plasticizer 11 11 – –
Stabilizer A 2 2 2 2
Stabilizer B 1 1 1 1
Stabilizer C 1 1 1 1
Volatility (active carbon method) 24 hrs. at 158°F., % loss 1.38 1.21 0.92 1.07
Clash-Berg, Tf, °C –24.4 –20.0 –23.9 –23.4
Heat Stability, minutes stable at 350°F 30 45 30 60
S.P.I. Impact Test (Masland) Pass/Fail °F Gauge –20/–25 0.019 –20/–25 0.020 –20/–30 0.019 –25/–30 0.021
Germicidal Lamp Test, 16 hrs., tack slight slight slight slight
Blooming, Room Temperature, press polished O.K. O.K. O.K. O.K.

This test shows

HEAT STABILITY OF PLASTICIZED VINYLS IS IMPROVED BY ESTERS OF ISOSEBACIC® ACID

ISOSEBACIC® acid, a new synthetic 10-carbon dibasic acid, has many plus values that recommend it as an intermediate for vinyl plasticizers. You'll see one example in the above figures—results of a test made recently by a processor of vinyl plastic film.

Read down columns 1 and 2. *Heat stability improves 50%* (from 30 minutes to 45 minutes) when 15 parts of an ISOSEBACIC acid ester replace 15 parts of an adipic ester in this formulation.

Read down columns 3 and 4 and you see an even more striking result in a test where higher ester levels were used. ISOSEBACIC acid ester actually *improves heat stability 100%* (from 30 minutes to 60 minutes).

Among the plus properties of ISOSEBACIC acid esters as vinyl plasticizers are:

- Low color
- Low odor
- Low oil extraction
- Low soapy water extraction

And ISOSEBACIC acid has other uses in the plastics field. It can be used as an intermediate for polyamides, polyesters, polyurethanes and alkyd resins. If you make any one of them—or a vinyl plasticizer—it will pay you to evaluate U.S.I. ISOSEBACIC acid. Send today for data sheets and samples.

CHEMICAL PROPERTIES

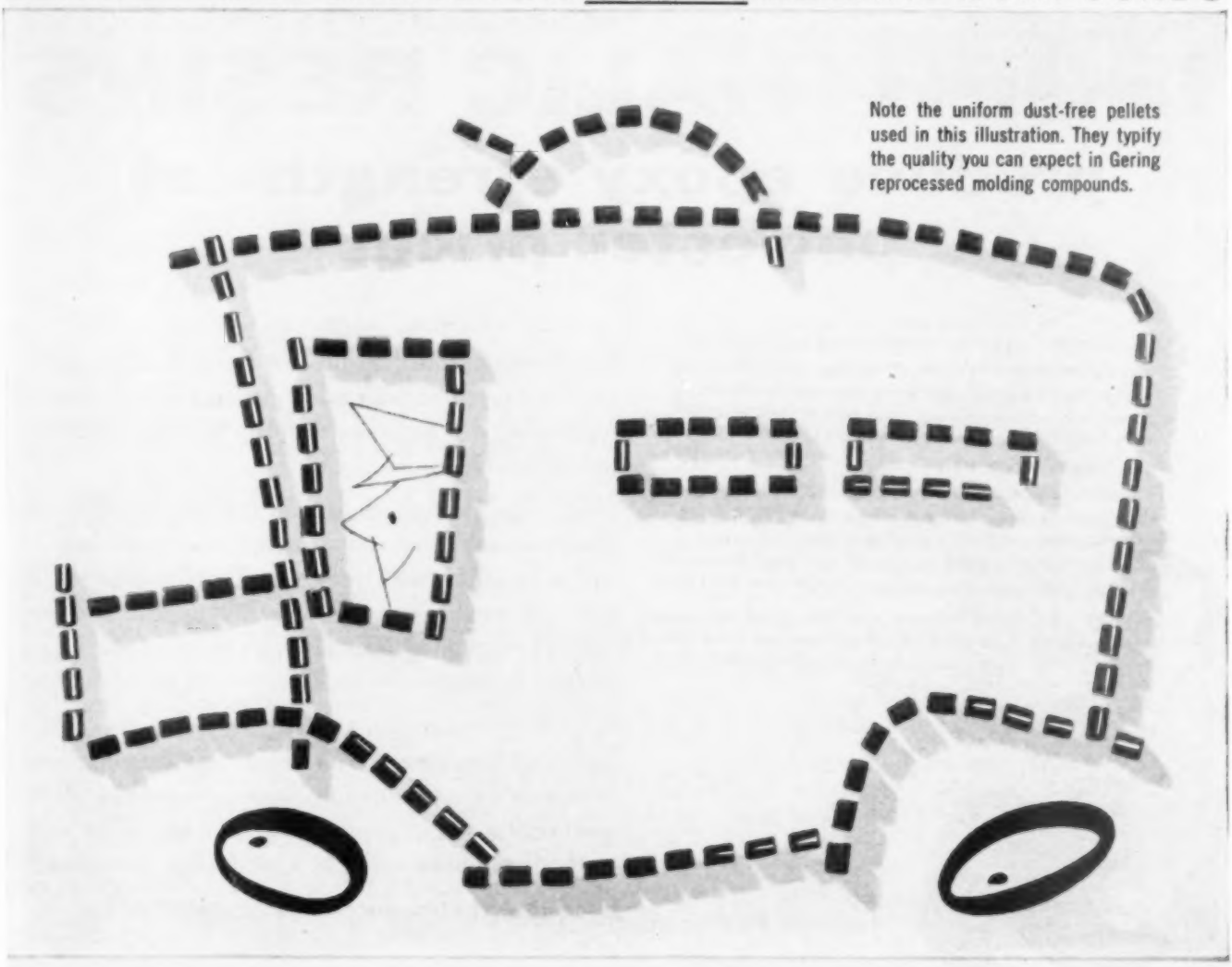
ISOSEBACIC acid is a mixture of C-10 dibasic acids—2-ethyl suberic; 2,5-diethyl adipic; and sebacic. It undergoes typical reactions of dibasic acids. It yields acid and neutral esters, acid and neutral salts. Relatively stable, it is not oxidized by air at ordinary temperatures.

PHYSICAL PROPERTIES

Molecular weight	202.24
Combining weight	101.12
Density (80°C)	1.025 g/ml
	8.55 #/gal
Melt viscosity (80°C)	78.5 centipoises
Specific heat of vapor (226°C)	0.34 cal/g (est.)
Heat of vaporization (226°C)	107 cal/g
Specific heat of solid (24°C)	0.33 cal/g
Heat of Combustion	1296 K cal/mole
Flash point (closed cup)	430°F.
Ionization constant at 25°C.	K_1 3.5 x 10^{-5}
	K_2 5.1 x 10^{-6}

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.
Branches in principal cities

GERING -- FIRST CHOICE FOR QUALITY MOLDING COMPOUNDS



Note the uniform dust-free pellets used in this illustration. They typify the quality you can expect in Gering reprocessed molding compounds.

Worth Getting, Worth Guarding

SAVINGS

with GERING REPROCESSED THERMOPLASTIC MOLDING COMPOUNDS

• Polyethylene • Vinyl • Styrene • Acetate • Nylon • Acrylics • Styrene Copolymers • Butyrate

There'll be savings by the truckload — for you! Gering reprocessed thermoplastic molding materials mean reduced costs, but not reduced quality. Fact is, molders who are quality-conscious point with pride to the end-products made with these compounds. You will, too. Now, with any given blend, you're absolutely sure of a top-quality molding compound — perfectly matched from first pellet to last. That's always so with Gering's up-to-date equipment, modern facilities and exacting system of quality controls.

For over 30 years, a continuous policy of individualized attention to customer needs has earned Gering its nationwide reputation for top-notch service.

Special offerings of high quality reprocessed thermoplastics are announced periodically through a new bulletin service. We'll be glad to send these money-saving notices to you. Just write us on your company letterhead.

GERING

Molding Compounds

Gering Products, Inc., Kenilworth, N.J.
Sales Offices: 5143 Diversey Ave., Chicago 39, Ill.
424 Chevy Chase Rd., Mansfield, Ohio

MORE PROOF

ISOPHTHALIC RESINS

produce epoxy strengths at polyester prices

Continuing product application research by Oronite and resin suppliers shows new evidence of Isophthalic's superiority as a basic raw material in the production of reinforced plastics.

There is good evidence to show that Isophthalic-based plastics have greater initial strength and toughness and, most important, their strength and toughness under use conditions is considerably superior to other types of resin based plastics. This suggests much longer life and service for Oronite* Isophthalic based plastics.

Such a serviceable material which can meet your cost requirements opens up new horizons and new applications for reinforced plastic products, as well as offering improvements in present plastic products.

Just contact the Oronite office nearest you and see how Isophthalic can benefit your company's products.

Physical properties of Isophthalic polyester

	Isophthalic Polyester Laminate (High Isophthalic Ratio Type)	MIL R-7575-A Polyester Laminate Spec.	MIL-R-9300 A Epoxy Laminate Specification
Flexural Strength†— Ultimate, PSI	70,000 - 77,000	50,000	70,000
Modulus of Elasticity (X 10^6)	3.3 - 3.7	2.5	3.2
Tensile Strength† Ultimate, PSI	48,000 - 53,000	40,000	47,000
Compression Strength† Ultimate, PSI	47,000 - 52,000	35,000	50,000
Barcol†	60 - 65	55	60

†Using 12 plys of 181 Volan finish cloth laminated with Isophthalic polyester resin according to specification method

ORONITE CHEMICAL COMPANY

A SUBSIDIARY OF CALIFORNIA CHEMICAL COMPANY

EXECUTIVE OFFICES • 200 Bush Street, San Francisco 20, California

SALES OFFICES • New York, Boston, Wilmington, Chicago, Cincinnati, Cleveland, Houston, Tulsa, Los Angeles, San Francisco, Seattle

EUROPEAN OFFICE • 36, Avenue William-Favre, Geneva, Switzerland

*T.M.

4714

NEWS in BRIEF

Totals for 1957 showed that the plastics industry exceeded its previous year's production figures for the sixth consecutive time, according to a report by SPI. Production of plastics and resin materials in 1957 totaled 4,387,000,000 pounds (an increase of 7% over 1956), and the total value of plastics products made last year was about $2,100-million (an increase of $50-million over the preceding year). Thermoplastic pipe production in 1957 totaled approximately 58-million pounds, as compared with 55-million pounds in 1956, and is expected to reach 60-million pounds this year. Cellular or foamed plastics totaled more than 30-million pounds in 1957 (an increase of about 100% over the preceding year), and is expected to achieve a total of about 40-million pounds this year. Based on the plastics industry's expansion plans, SPI estimates a 1-2% increase in over-all plastics output in 1958.

Vinyl-metal laminate bonding process that eliminates high-temperature deterioration of the materials used has been developed by Arvin Industries. The process is especially valuable in the manufacture of radio and TV cabinets, and other items that may be exhibited in display areas where they are subjected to sunshine, weather changes, and severe radiant heat.

Growth of the thermoset plastics industry depends upon the creative work that can be performed by the thermoset molders' salesmen, says P. E. Fina, director of Sales engineering for Fiberite Corp. (see Guest Editorial, pg. 137). To get past the purchasing agents, the salesman must show that he has a sound and basic knowledge of the materials available. He admonishes molders who want more thermosetting work, "Look at your salesman!"

Business developments in the plastics industry were varied in nature. A new research and development group, Larkin Associates, Inc., opened offices in Huntington Station, N. Y. Its new plant in Gastonia, N. C., was dedicated by Northwest Plastics, Inc. Plas-Tech Equipment Corp., has opened a new consulting service specializing in research development, and evaluation and testing of materials. National Lead and Celanese are collaborating on plastics polymer research, using newly-developed catalysts.

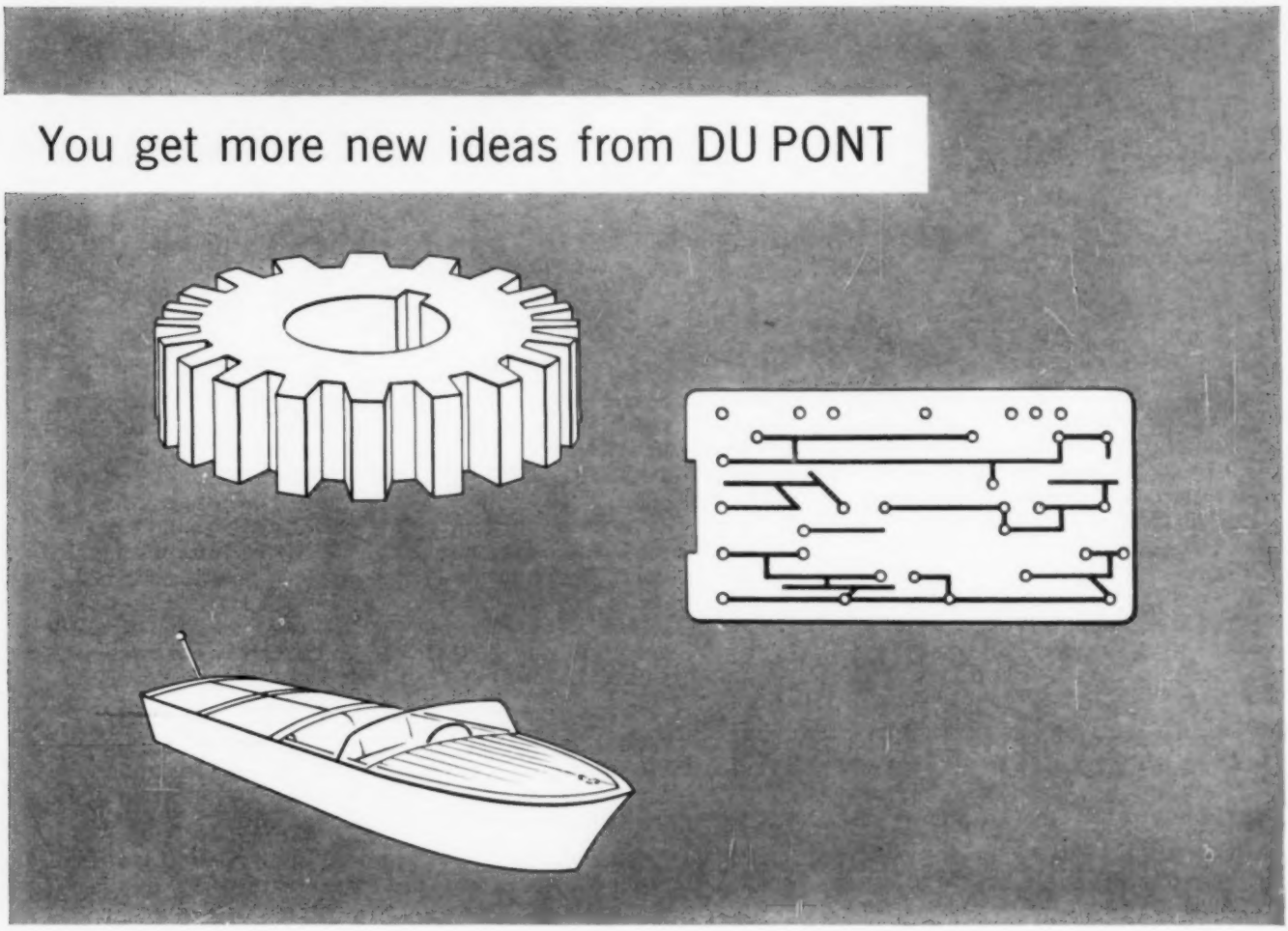
Company expansion in the plastics industry continued in evidence. Its $18-million high-density polyethylene plant at Baton Rouge, La., was placed on stream by Grace's polymer chemicals division. Goodrich Chemical is constructing the country's first glacial acrylic acid plant in Calvert City, Ky. Molded Fiber Glass Boat has begun capacity production of 12½- and 15-foot reinforced plastic boat hulls at its new Union City, Pa., plant.

New Materials of special interest (see pages 162-5): polypropylene molding material; aqueous alkyd resin emulsion; urethane intermediate for flexible foams; clear epoxy baking varnish; black epoxy casting resin; two epoxy-stearate plasticizers; high-solvating primary plasticizer; low-temperature plasticizer for vinyls; and two vinyl stabilizers.

New Equipment worthy of mention (see pages 166-8); high-speed printing presses; side-loading puller for plastic pipe, tubing, and rod; insulation resistance tester; carbide-tipped saw blades; controlled-heat brander; and portable pneumatic power saw and file.

Plastics Applications to be noted (see pages 169-72): durable game boards of high-impact styrene sheet; miniature floats of polyethylene foam; glass-polyester aircraft skis; glass-polyester jacketing for pipe conduits; cementable fluorocarbon tapes both with and without glass cloth reinforcement; fluorocarbon laminate linings for making equipment corrosion-resistant; epoxy repair kit for tools and castings; strip-off PVC plastisol coating for protecting metal parts; hand-held, phenolic-housed, photographic light; vinyl mounting pads for machinery; and modified-styrene supports for furniture.

You get more new ideas from DU PONT



New stabilized MPD S Technical especially designed to give lighter colored, more uniform epoxies

Du Pont m-Phenylenediamine (MPD for short) was one of the first curing agents used for epoxy resins . . . and still is one of the best. Now improved and stabilized and known as m-Phenylenediamine S Technical, this all-around curing agent is hard to beat in making those epoxy resin laminates and castings destined for end-use at high temperatures where color is of prime importance.

Today's MPD S is available in flake form – easier to handle, weigh, use. It's always uniform, completely stable . . . in the drum, in the pot *and* in the resin.

New MPD S is light in color and darkens only slightly on storage. It provides added assurance of obtaining the stable, light color desired in laminates and castings you make or fabricate.

If you'd like a sample of the new, *stabilized* Du Pont MPD S Technical, call your nearest Dyes and Chemicals District Office, or write E. I. du Pont de Nemours & Co. (Inc.), Organic Chemicals Dept., Dyes and Chemicals Division, Wilmington 98, Delaware.

DU PONT
REG. U.S. PAT. OFF.

Better Things for Better Living
. . . through Chemistry

ORGANIC CHEMICALS DEPARTMENT

"The resemblance to the real aircraft is remarkable!"

New Link Simulator Cockpit For Douglas Jetliner Built Economically

with RCI POLYLITE RESIN

Realistic surroundings help train air crews for tomorrow's jet transports. It is vital that conditions encountered in actual flight be simulated closely on the ground.

Even the exterior appearance of the training model should be lifelike. And the Link Aeronautical Corporation of Endicott, N. Y., which builds the cockpit for Link Aviation, Inc. in Binghamton, N. Y., has found that reinforced plastic construction utilizing RCI POLYLITE polyester resin now makes it possible to duplicate every outside detail accurately and economically.

Mr. Felix Aimonetti, Vice President and General Manager of Link Aeronautical states: "The use of POLYLITE polyester resin as a laminating agent helps make this Douglas DC-8 training cockpit a rigid, durable, realistic structure, with a surface that resists corrosion and is easily painted. Our experience with POLYLITE resin has continued to impress us with the high quality of laminating it performs."

If you think that RCI POLYLITE polyester resin can be incorporated in one of your products and wish information about its use in laminating, molding and other reinforced plastic applications, write for free Booklet B.

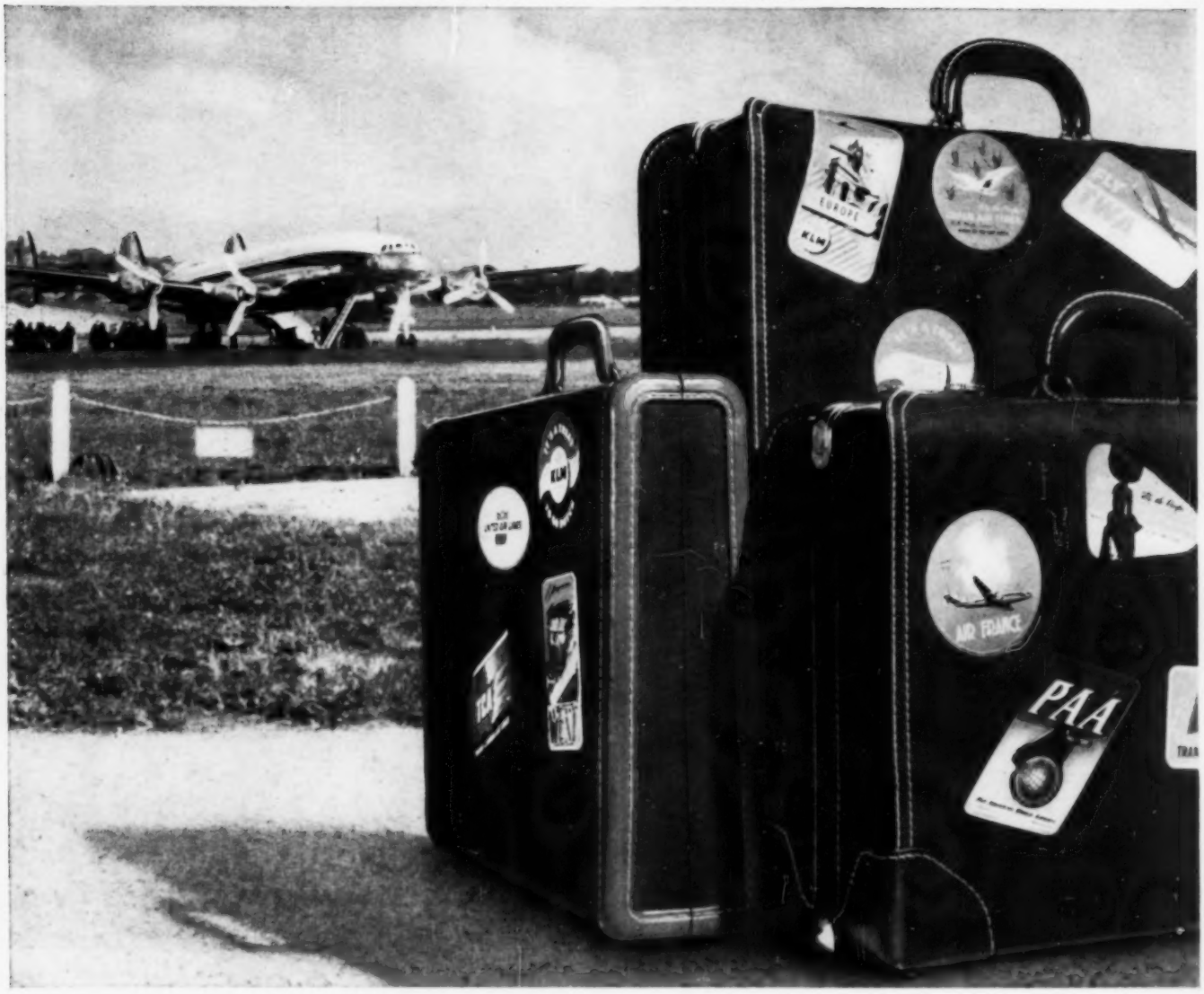
REICHHOLD

Synthetic Resins • Chemical Colors • Industrial Adhesives
Phenol • Hydrochloric Acid • Formaldehyde • Glycerine
Phthalic Anhydride • Maleic Anhydride • Sebacic Acid
Ortho-Phenylphenol • Sodium Sulfite • Pentaerythritol
Pentachlorophenol • Sodium Pentachlorophenol
Sulfuric Acid • Methanol

REICHHOLD CHEMICALS, INC.,
RCI BUILDING, WHITE PLAINS, N. Y.

RCI
Creative Chemistry... Your Partner in Progress

TOMORROW'S PRODUCTS TODAY...THROUGH ENJAY PETROCHEMICALS



Basic raw materials for VINYLS that add new style to lightweight luggage!

Colorful, lightweight luggage is now made with vinyl—and the demand is great! The current large use of vinyl plastics has placed increasing importance on the quality of the plasticizers used in these products. Naturally, manufacturers want the best.

Enjay Isooctyl and Decyl Alcohols make excellent plasticizers. Like all Enjay petrochemicals, they meet the most exacting standards of uniformity and purity.

The recently expanded Enjay Laboratories are fully equipped to assist you in the application of Enjay petrochemicals to your products. Just call or write for complete information.

Enjay offers a widely diversified line of petrochemicals for industry:

ALCOHOLS & SOLVENTS: Lower Alcohols, Oxo Alcohols, Ketones and Solvents; OIL & FUEL IMPROVERS: Detergent-Inhibitors, V-I Improvers, Oxidation-Inhibitors; CHEMICAL RAW MATERIALS: Olefins, Diolefins, Aromatics; ENJAY BUTYL RUBBER & VISTANEX.

ENJAY

Pioneer in Petrochemicals

ENJAY COMPANY, INC., 15 W. 51st STREET, NEW YORK 19, N. Y. Akron, Boston, Chicago, Detroit, Los Angeles, New Orleans, Tulsa

Get maximum jetness in Polystyrene

with savings of

TIME, BLACK COSTS and REJECTS

Use Columbian's

COSTYRENEBLAK-CJ

35% dispersion of colloidal carbon black in polystyrene resin

- Easier compounding . . . on two-roll mill or in extruder. No pre-milling needed.
- Fewer rejects . . . better dispersion, less streaking. Cleaner, less danger of contamination.
- Economy . . . a little goes a long way.

COLUMBIAN CARBON DISPERSIONS FOR EVERY PLASTIC

- COVINYLBLAKS®
- COWAXBLAKS
- COETHLOBLAKS®
- COACETATEBLAKS

COLUMBIAN CARBON COMPANY

380 Madison Avenue · New York 17, N. Y.

● **COLUMBIAN** Carbon Blacks are available in three forms: **POWDER · BEADS · DISPERSIONS** ●

HERBERT HOOVER

IT'S

The Waldorf Astoria Towers
New York, New York
December 10, 1957

Dear Mr. Salisbury:

The business press has long been a mainstay of our industrial development. It is always helpful when business publications also take part in governmental and public affairs.

The Bill Brothers Publishing Corporation is performing a notable civic service with its new advertising series on the Reports of the Commission on Organization of the Executive Branch of the Government.

The need for federal economy and efficiency was never more clear. You are helping greatly to enlist support for the Commission's recommendations at a critical time.

Yours faithfully,

Herbert Hoover

Mr. Philip Salisbury
Bill Brothers Publishing Corp.
386 Fourth Avenue
New York 16, New York

YOUR MONEY

70 billion dollars of it... to be spent without Congressional review

Legislation to correct this situation is now before Congress. *Plastics Technology* believes you'll want to give it your support.

The bipartisan Hoover Commission found that Congress often makes lump-sum appropriations for long-range projects and programs. This permits federal agencies to pile up unexpended "carry-over" funds year after year, much of which receives no further Congressional review. The total "carry-over" today is estimated at $70 billion – almost equal to the entire amount granted by Congress for the present fiscal year . . . dollars that would buy a lot of progress on the missile research front, for example.

The Hoover Commission recommends that the Government adopt "annual accrued expenditure budgeting." This sounds complicated but simply means that Congress would, in a given year, appropriate only for the goods and services the Government *purchased* in that year. This is the basis on which modern business – and most homes – are operated.

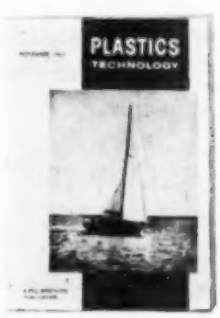
Last year the Senate expressed its approval of this modern budgeting practice (S.434) without a dissenting vote. The measure was approved by the House of Representatives Committee on Government Operations and by the House Rules Committee. Now only a House floor vote on H.R. 8002 is needed for its adoption.

Where you get into the act

If you feel the way most business men do, you'll want to follow the progress of this bill and get a note off to your own congressman at the appropriate time. This move is up to you, and nobody else.

However, as a member of *Bill Brothers Publishing Company*, we'd like to make it easy for you to receive, without cost, informative mailings about this and other recommendations of the bipartisan Hoover Commission that can save billions more at this critical time when every dollar is needed for scientific development.

You, as a business man, are eligible to become a member of the Citizens Committee for the Hoover Report, a nonprofit, bipartisan organization dedicated to the idea of increasing efficiency in government. There is no obligation other than your own desire to help. There is no cost unless you choose to contribute. The coupon below will start information on its way to you.



PLASTICS
TECHNOLOGY
A BILL BROTHERS PUBLICATION
386 Fourth Avenue, New York 16, N. Y.

FAST FOOD • FLOOR COVERING PROFITS PLASTICS TECHNOLOGY • PREMIUM PRACTICE • RUBBER WORLD • SALES MANAGEMENT • SALES MEETING • TIDE • TIRES TBA MERCHANDISING

BILL BROTHERS PUBLICATIONS

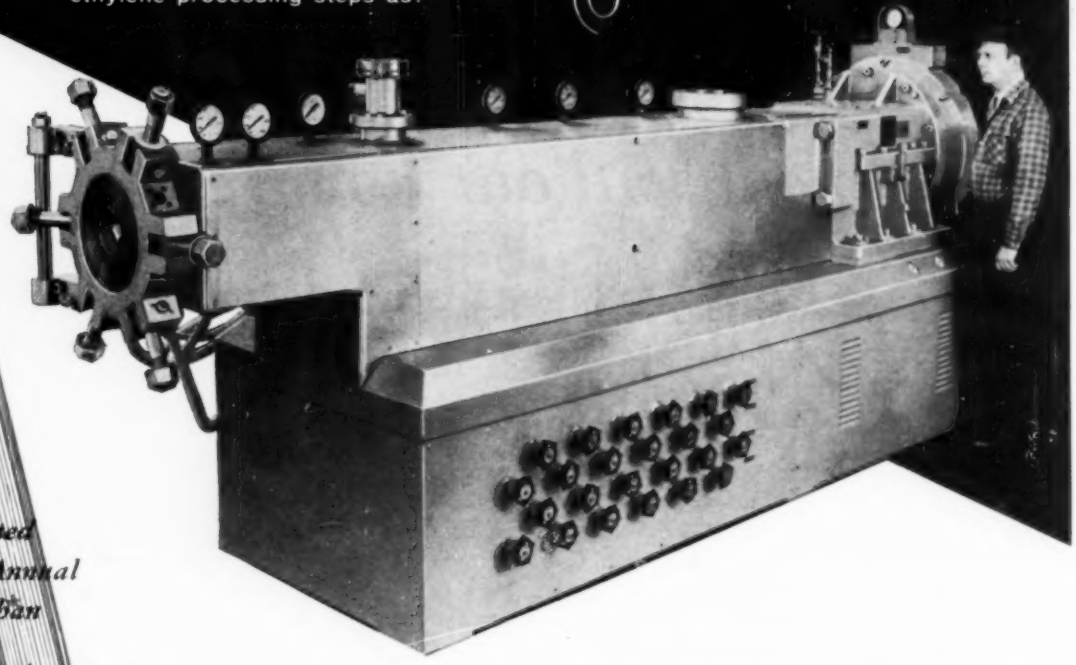
PLASTICS TECHNOLOGY
Bill Brothers Publications
386 Fourth Avenue, New York 16, N. Y.

Yes, I would like to receive, without obligation, a membership card for the *Citizens Committee for the Hoover Report* and a copy of the Committee Member's Handbook, Reorganization News, and other current cost-cutting legislative information.

name_____
title_____
company_____
address_____
city_____ zone_____
state_____

THIS KIND OF CONFIDENCE MUST BE BUILT ON PROVEN PERFORMANCE: More than two tons out of every three of Low Pressure High Density Polyethylene are on schedule for processing via W.E.I. equipment in key manufacturing plants throughout the world. This record testifies to the reliable year-round performance of Welding Engineers' specialized machinery for such important low pressure polyethylene processing steps as:

1) DENSIFYING
2) MOISTURE REMOVAL
3) SOLVENT REMOVAL
4) COLORING
5) PELLETIZING



Welding Engineers' Equipment Is Credited With A Combined Annual Capacity of More Than

374 Million Pounds of High Density Low Pressure Polyethylene

IMPORTANT:
Many Compounder-Extractor-Extruders Are Equipped With W.E.I. Hot-Cut Pellet Systems

International figures for this sky-rocketing thermoplastic put the production spotlight squarely on the performance of Welding Engineers' dual worm compounder-extractor-extruders. The proof of their performance is evidenced by literature published by W.E.I. customers testifying "plant operations with no changes required have proved satisfactory" . . . thus confirming the correctness of the extrapolation of the equipment from laboratory testing to plant operation. If low pressure high density polyethylene is playing an important part in your 1958 planning, it is time to see W.E.I. equipment in action . . . to superimpose your production problems on W.E.I. accomplishments.

WELDING ENGINEERS, INC. NORRISTOWN, PENNSYLVANIA

Specialists in the development and manufacture of continuous operation Dual Worm Compounder-Extruders • Dual Worm Devolatilizers • Dual Worm Extrusion Dryers • Single Worm Extruders • Send for Catalog No. 663

PLASTICS
TECHNOLOGY

Some Aspects of the Stabilization of Vinyl Insulation

The importance of test temperature, lubricants, plasticizers, fillers, stabilizer dispersion characteristics, processing temperature, and weathering on volume resistivity

J. G. HENRICKS, *Mgr., Rubber & Plastics Dept.*
and
N. L. COOPERMAN, *Chemist, New Prod. Development,*
Research Laboratories, National Lead Co., Brooklyn, N. Y.

ENORMOUS changes have taken place during the past 10 years in the vinyl insulation field. Many materials, methods, and formulations are available today, and concern centers around specialized compounds for specific end-uses consistent with highly competitive costs, competitions from other plastics, and the constant need for expansion of markets. The utilization of every possible aspect of compounding and processing techniques, therefore, has ever-increasing importance.

The present discussion relates primarily to the effects of a number of such factors on volume resistivity, particularly as measured over a range of temperatures. Emphasis also is given to the thesis that unilateral consideration of an isolated property is not compatible with the demands of the current competitive market.

Test Temperature

The constantly-increasing use of vinyl insulation for higher temperature applications has developed an awareness of the influence of temperature on resistivity. Most laboratories also are aware that the order of merit of volume resistivities for different compounds can change markedly at different temperatures of test. In practice, however, tests usually are conducted at a single standardized temperature.

The data of Figure 1 serves to remind that such temperature changes do occur, and can be important. The data compare three systems varying only in stabilizer selection, and show marked differences in their order of merit electrically at elevated temperatures as compared to room temperature.

Practical economics rarely permit the testing of all systems over a broad temperature range. Competitive forces, however, plus the increased complexity of products, suggest the desirability of increased consideration

Presented at the Sixth Annual Symposium on Technical Progress in Communication Wires & Cables, sponsored by the Signal Corps Engineering Laboratories, Asbury Park, N. J., Dec. 3, 1957.

John G. Hendricks was born in Boston, Mass., in 1921. He attended Northeastern University, M.I.T., and the Polytechnic Institute of Brooklyn, receiving a B.S. in Chemical Engineering in 1943, and an M.S. in Chemistry in 1945. From 1940-42, he was a chemist for Avon Sole Co., and was a research associate for M.I.T. in 1942-43. He joined National Lead in 1943 as manager of the Rubber & Plastics Dept. of the company's Research Laboratories, a position he still holds. Mr. Hendricks is the author of a number of papers and holds many patents in the rubber and plastics fields. In his work, he has been instrumental in the development of many commercial stabilizers for vinyl plastics. His professional affiliations include memberships in A.C.S., the New York and Boston Rubber Groups, Committees D-11 (Rubber) and D-20 (Plastics) of A.S.T.M., S.P.I. (he is chairman of Group III—Weathering for the Society), and the American Management Association. Mr. & Mrs. Hendricks and their two boys live currently in Boonton, N. J.

Norman L. Cooperman was born in Newark, N. J., in 1922. He attended Rutgers University, receiving a B.S. in Chemistry in 1943. He was employed as a chemist by H. Muehlstein & Co. in 1939-40, and by Middletown Rubber Corp. in 1940-43. After service in the Army from 1943-46, he joined Thompson Weinman & Co. in charge of the Rubber & Plastics Dept. of the firm's research laboratories. From 1953-55, he was Project Manager for Plastics Additives for Nuodex Products Co. He joined National Lead Co. late in 1955 in his present capacity as chemist for the New Product Development Dept. of the firm's Research Laboratories, where his principal field of activity is in technical service to the vinyl industry. Mr. Cooperman is a member of A.C.S., SPE, and the New York Rubber Group. He, his wife, and their three children reside in Springfield, N. J.

of test temperature selection. Such selection based on actual processing and end-use requirements is indicated to obtain practical and meaningful data. However, extrapolation of results to new conditions of composition or use should be approached with the utmost caution.

Lubricants

Lubricants have a very strong effect on volume resistivity. The extent and direction of this effect are dependent not only on test temperature, but also on the test formulation. These factors can determine whether specific lubricants are helpful, innocuous, or harmful to resistivity.

Stearic acid generally is considered detrimental to electrical properties. This is true generally, but not necessarily true specifically. Figure 2 compares the effects of adding stearic acid to three unlubricated compositions over a range of temperature. The compositions, in phr., of the three compounds in this Figure, are as follows:

	Formula 1	Formula 2	Formula 3
Resin	100	100	100
DDP	40	25	25
DOP		25	25
Pentaerithritol ester	15		
EG clay	10	10	
Whiting	10		
Tetrabasic lead fumarate	5		
Tribasic lead sulfate		5	5

Similar data can be developed for other lubricants. Such information can be used to prove that any one of several lubricants has the best effect on volume resistivity. They actually prove, however, the need for great caution when extrapolating results from one base temperature to another. There is a very human tendency to conclude that such data show one of the additives used in the Figure 1 compositions to be the best lubricant. In fact, however, the data contain no information on lubricity, the defined function of the lubricant additive.

Common lubricants exhibit distinct differences in lubricating action, depending on the processing temperature. This should serve to underscore the possibility of utilizing each component to provide plus values for a variety of properties when the weighted integration shows real advantages. For example, marked positive contributions to heat stability, weathering resistance, and moisture repellency can be achieved by appropriate selection of the lubricant.

Plasticizers

A detailed comparison of the resistivity characteristics of the hundreds of commercial plasticizers is beyond the scope of this paper. It does seem appropriate, however, to point out one of the possibilities that is available for utilizing plasticizers to develop improved process and product characteristics.

Glyceryl tri-acetoxystearate shows no advantage

electrically at room temperature, but does show distinct advantages in volume resistivity at elevated test temperatures (see Figure 3). The merit of this approach is enhanced because tri-acetoxystearate provides the unusual combination of improved resistivity at elevated temperatures with lubricant action.

Fillers

Clays have been used, almost traditionally, to increase the resistivity of primary insulation. In the absence of practical alternatives, the advantage gained overshadows the reactvity and degrading effect of the iron in the clays; even the further problems arising from marked variations in the iron contents of different lots of the same clay.

Practical alternatives are beginning to appear for many quality applications where optimum color and stability are desired. Figure 4 shows added advantages in color, heat stability, and retention of elongation upon aging four days at 136° C. The compound used in this test had the following composition, in phr.: resin, 100; DOP, 25; DDP, 25; EG clay, 10; and stabilizer, 5. Blends of the special whiting and clay show synergistic enhancement of resistivity, in addition to improvements in color, stability, and retention of physical properties relative to clay.

Coatings

Some salt stabilizers, such as dibasic lead phthalate, process very well; are highly resistant to moisture; and are unaffected by adverse conditions of storage. Some stabilizers (and other components) need a surface coating either for processing or to prevent agglomertion and subsequent poor dispersion characteristics. Although such coatings are present only in minute quantities (about 0.03) in the compound, they can alter the electrical properties appreciably.

Tribasic lead sulfate requires a coating for optimum characteristics. Figure 5 shows that the electrical properties of stearate coating are affected adversely at 60° C. and higher temperatures. A special hydrocarbon coating has no detrimental effect over the 30-100° C. temperature test range. Incidentally, the compositon of the compound investigated was the same as in Figure 4.

Dispersion

The dispersion characteristics of stabilizers and other solid components in plastids are of utmost importance. Inadequate dispersion is reflected in faulty insulation, excessive build-up in extruder die heads, and poor original and retained physical properties. Electrical properties and stability also may be affected. Pre-tested stabilizers, however, are available as standard products.

This aspect may be taken a step further when justified economically. Figure 6 shows that predispersion of stabilizer and/or filler in the plasticizer has a decidedly beneficial effect on retention of physical properties (after four days at 136° C), as well as on volume resistivity and stability. Predispersion was done in a Morehouse mill, grinding to a fineness of NS5. The data shown here are most pertinent to dry-blending processes.

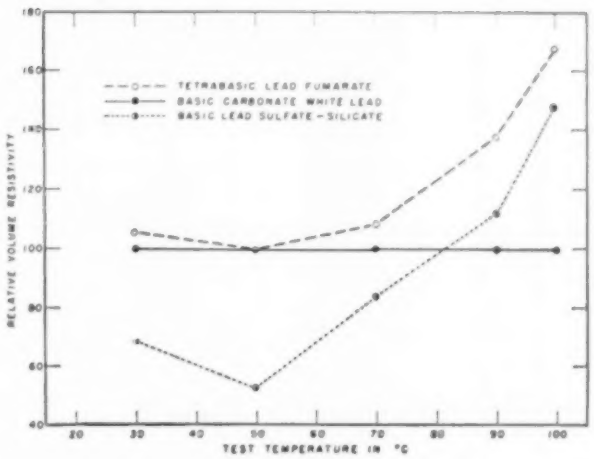


Fig. 1. Effect of stabilizer and test temperature on relative volume resistivity of vinyl compounds.

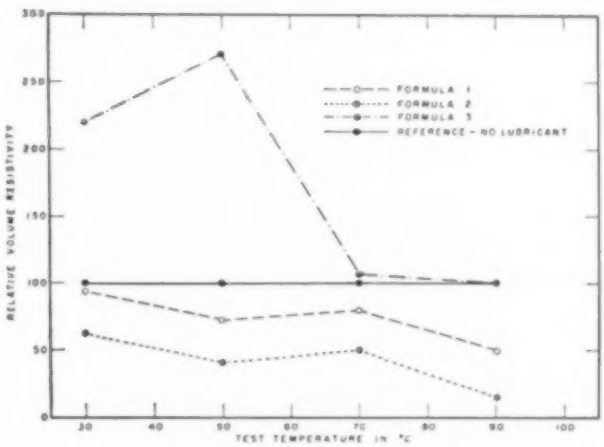


Fig. 2. Effect of stearic acid lubricant on relative volume resistivity of vinyl compounds.

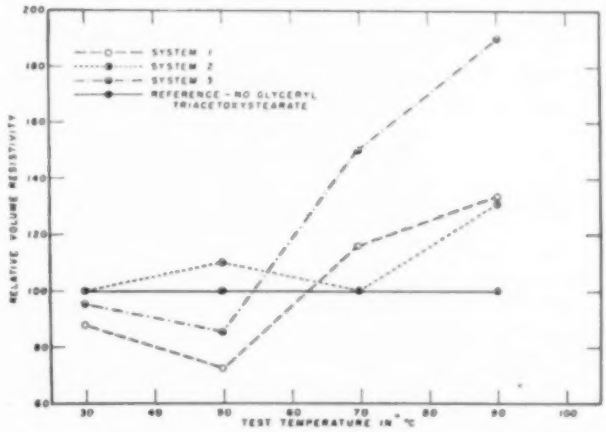


Fig. 3. Effect of glyceryl tri-acetoxystearate plasticizer on relative volume resistivity of vinyl compounds.

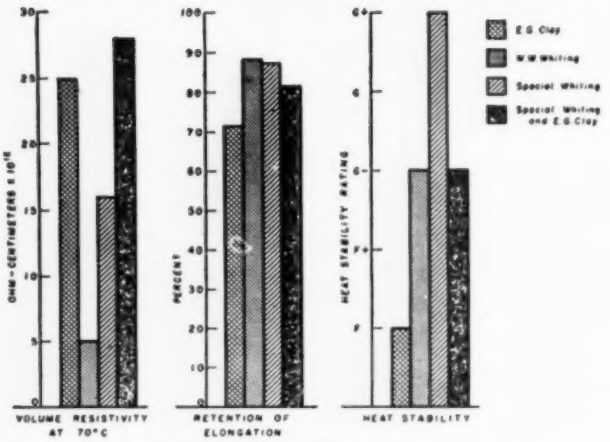


Fig. 4. Effects of four fillers on vinyl insulation properties.

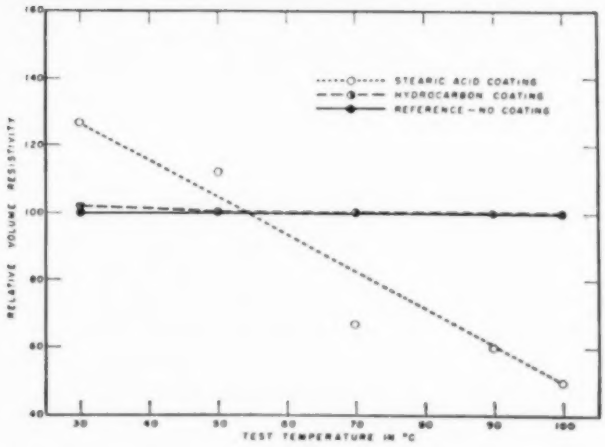


Fig. 5. Effects of various stabilizer coatings on relative volume resistivity of vinyl compounds.

Insulation Thickness

Higher processing temperatures, higher application temperatures, and dry blending all represent increased quality demands. One of the more recent innovations utilizes vinyl plastics for thin-wall insulation. Such application emphasizes the desirability of using non-gassing components, since the gassing types can cause pin-holing of the insulation.

Processing Temperature

Volume resistivity and other properties are dependent on the temperature of processing. Specifically, resistivity is decreased by higher processing temperatures, particularly when measured at higher test temperatures. Figure 7 illustrates this conclusion, and also the necessity of considering the effects on other properties.

Complete fusion is required for optimum performance of several key characteristics, and may indicate a compromise temperature, as in the case used as an example. Because of their effect on fusion temperatur, plasticizer systems have a strong influence in this, as well as more recognized, areas.

Weathering

Out-door application of vinyl insulation provides an increasingly important specialty market. The effect of weathering on the volume resistivity is almost com-

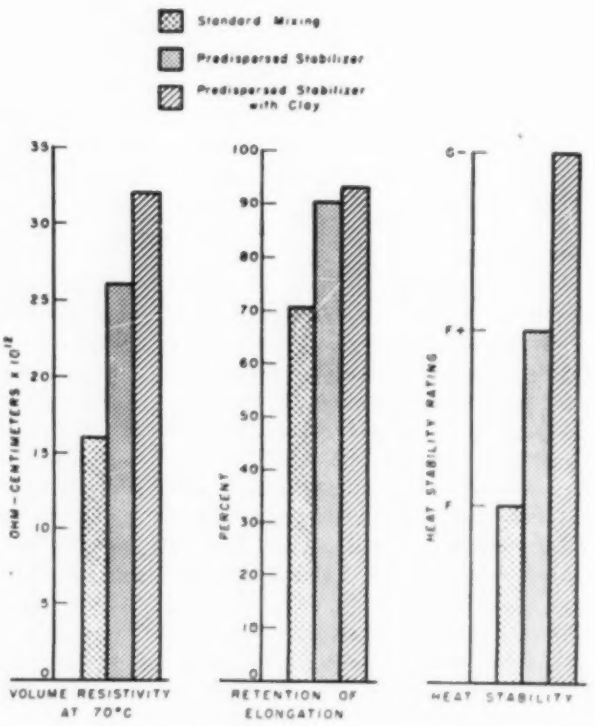


Fig. 6. Effect of predispersion of components on properties of vinyl insulation containing stabilizer.

Table I. Effect of Weathering on Volume Resistivity* and Elongation Retention**. (Compound containing 100 parts resin, 50 phr. DOP, 10 phr. clay, 5 phr. stabilizer)

	Volume Resistivity at 30° C., 10^{12} Ohm-Cm.						% Retention of Elongation
Exposure: Weeks	0	3	5	13	26	31	26
Radiaion, 10^3 Langlies	0	10	18	44	66	72	66
Stabilizer:							
Basic silicate white lead	290	35	25	0.07	—	—	53
Basic carbonate white lead	375	20	7	1.2	—	—	70
Dibasic lead phthalate	380	80	25	14	8	0.3	72
Dibasic lead phosphite	405	105	40	30	21	14	83
Dibasic lead phosphite + rutile titanium dioxide	250	95	40	31	26	21	91

*Resistivity measured on 12-mil film.
**Elongation measured on 80-mil sheet.

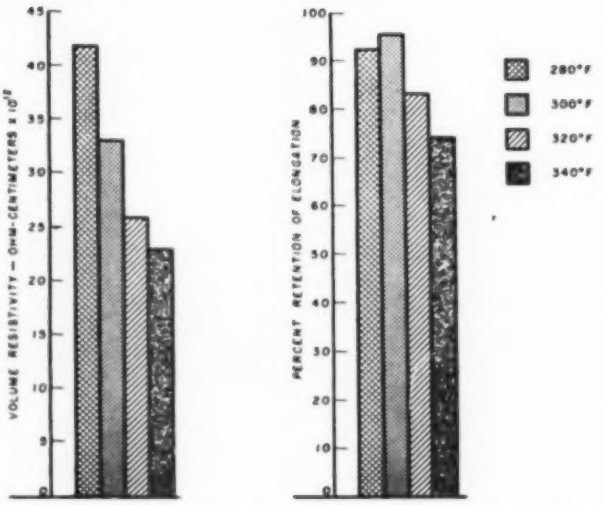


Fig. 7. Effect on various processing temperatures on volume resistivity and retention of elongation.

pletely a function of the weathering resistance of the plastic. Table 1 shows that those electrical-grade stabilizers and additives (such as rutile titanium dioxide) that are most effective in imparting weather resistance are also most effective in retaining volume resistivity after out-door exposure.

Conclusions

Volume resistivity of vinyl insulation is influenced by many factors. The relative effect of each factor is dependent on the conditions selected to represent the other factors. Changes in materials or processes made to improve resistivity influence a spectrum of properties. This suggests that resistivity may be enhanced further and greater over-all benefits derived by re-balancing the other components of the formulation. These, of course, are not new concepts; they are basic principles.

The knowledge and skills involved in formulating and testing improved plastics are well developed, and are constantly being extended and polished. Of equal importance, however, are the habits and attitudes with which these problems are approached. These factors, the reflections of individuals, laboratories, and managements, can provide the key to some of our most pressing technical problems. —THE END

Epoxy Inserts for Honeycomb Structures

Aluminum fasteners for the steel bolts are sealed into the epoxy core plugs with additional epoxy putty.

With the advent of lightweight sandwich construction, aircraft designers were faced with the problem of how to attach these core-and-face structures to the supporting airframe. Conventional mechanical fasteners were found to crush the internal core, which had very little compression strength in highly localized areas.

Douglas Aircraft engineers came up with a highly successful solution to this problem while designing the sandwich-type access doors for the Air Force's C-133A turboprop cargo-transport. These eight doors, located on twin landing gear pods are fabricated of multiple layers of honeycomb aluminum core faced with reinforced plastic skins. To attach metal hinges and the locking mechanism required 40 through-sandwich attachments and 20 blind attachments.

Narmco Formula Putty 3119, a room temperature-setting filled epoxy produced by Narmco Resins & Coatings Co., was used to obtain local bearing strength within the core material. Twenty ½-inch holes were drilled through one skin and the core, and the putty was inserted into the surrounding core area to the first vertical cell column. When the putty had jelled and cured for about four hours, ¼-inch holes were drilled into the putty plugs. Metal bolts then were inserted and fastened with nuts, thus securing the hinges.

Blind attachments for the locking mechanism were made by forming similar putty cores and fitting steel bolts through the internal skin into the aluminum fasteners. Shear tests of the completed structure showed both the skins and the honeycomb cores to fail before the putty-supported attachments.

—THE END

P. M. KAMATH,* *Research Chemist,*
and
H. O. BUZZELL, *Tech. Specialist,*
Research Division,
Polaroid Corp.,
Cambridge, Mass.

Measuring the Abrasion Resistance of Plastic Lenses for Sunglasses

Results of laboratory tests, using a new type of abrader, give good correlation with field tests for comparing different plastic lens coatings

ALTHOUGH sunglasses may employ lenses of plastic or glass, plastic lenses usually are preferred because they are light-weight, non-shatterable, and inexpensive. Any desired color may be achieved by the manufacturer by incorporating a suitable dye in the plastic material before the lenses are formed. In some brands, polarizing layers are included for selective absorption of reflected glare from roads, sidewalks, automobile hoods, water surfaces, etc.

Despite their many points of superiority, plastic sunglasses have suffered from one notable drawback: the care that must be exercised to prevent damage to the lens surfaces. Dust and fingerprints inevitably accumulate on the lenses, and when the user tries to clean them by rubbing with a handkerchief, he may permanently impair the lenses' clarity. Even moderately gentle rubbing of a soft plastic lens eventually can produce a sufficient number of microscopic scratches that give the lens a hazy, cloudy appearance. Sunglasses left in the glove compartment of an automobile may become scratched from continual vibration in contact with dust-covered surfaces. Not uncommonly, sunglasses that have been in use for only a few months may have to be discarded, due to the large build-up of haze.

To increase resistance to abrasion, the lenses may be coated during manufacture with a plastic material known to be hard and tough. Many kinds of coatings may be used, and the problem is to determine which kinds combine high optical quality with outstanding toughness.

To compare the abrasion resistance of different coating materials, the manufacturer may employ field tests or laboratory tests. Field tests entail distributing sunglasses to a large number of people, inviting them to use the sunglasses in whatever way they consider normal, and arranging for them to return the sunglasses periodically for quantitative appraisal. Laboratory tests involve subjecting the sunglasses to standardized abrasion in the laboratory.

Field tests take many months to complete. Since these tests are carried out in different parts of the country, at different times of the year, and by different kinds of users, the results may be misleading. Actually,

*Now with National Distillers Products Corp., Cincinnati, O.

there is no such thing as "typical treatment" of sunglasses.

The laboratory tests, in addition to being quick and inexpensive, provide higher precision owing to the use of controlled, uniform test conditions.

Both kinds of tests were made in the program reported here, and a gratifying degree of correlation was found between them, as explained in a later section. Good correlation was achieved, however, only after an improved type of abrader, described below, had been developed. Only after making exhaustive tests using this abrader could one have full confidence that the best of the newly-explored coating materials does indeed provide an impressive increase in abrasion resistance.

Laboratory Tests

Laboratory methods of evaluating the abrasion susceptibility of plastic sheets have been available for many years*, but are applicable only to flat samples. Sunglass lenses are curved; usually, they have the "six-curve" shape of a meniscus lens whose radius of curvature is about 3.5 inches. Instead of testing the coated (curved) sunglass lenses themselves, we could apply the coatings to flat sheets and test these. However, doubt would exist then as to whether the results were valid, since a different coating thickness or baking temperature might have been used. Also, coatings present on curved surfaces might have different stress distributions and different adhesive strengths from those on flat surfaces. At the outset of the present project, therefore, the decision was made that all tests should be made on the curved lenses themselves to insure the reliability of the test results.

Initially, we had intended to use an existing standard method for abrading the surface of plastic specimens; namely, the method specified in the A.S.T.M. Mar Resistance Test Method D673-44. It was soon found, however, that this method is inapplicable. It involves subjecting the plastic lens to a "rain" of carborundum grit that falls from a specified height onto the center of the specimen. Each particle impinges at high speed and either bounces off without producing damage or produces a damage at one point only. In actual use lenses are damaged by slow rubbing or wiping motions that drag grit particles across the surface of the lens. If a specimen is sufficiently compliant so that it can recoil locally when struck by a falling particle, the likelihood that damage will result is decreased. Compliance, however, does not necessarily tend to reduce damage from a wiping motion.

Polaroid Type B Abrader

Successful results were obtained using the specially designed apparatus shown in Figures 1 and 2. This instrument, the Polaroid Type B Abrader, was designed to abrade the convex surface of the six-curve lens by means of a repetitive, rectilinear wiping motion. The abrading action is effective over an appreciable area of the lens surface, rather than being concentrated at the mid-point. Any desired load (pressure), any desired

*A.S.T.M. Methods D1044-54T, D1242-52T, and D673-44.

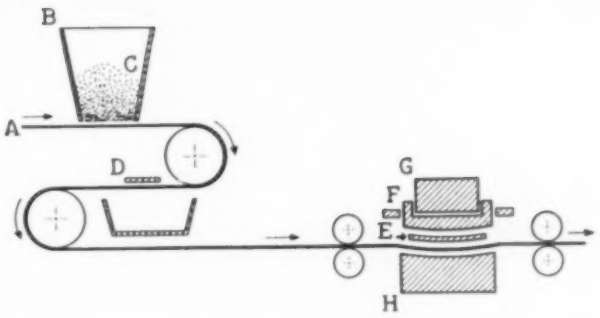


Fig. 1. Cross-sectional drawing of Polaroid Type B Abrader, showing A—Tape; B—Hopper; C—Abrasive; D—Vibrating Blade; E—Specimen; F—Specimen Holder; G—Load; and H—Supporting Block for abrasion test.

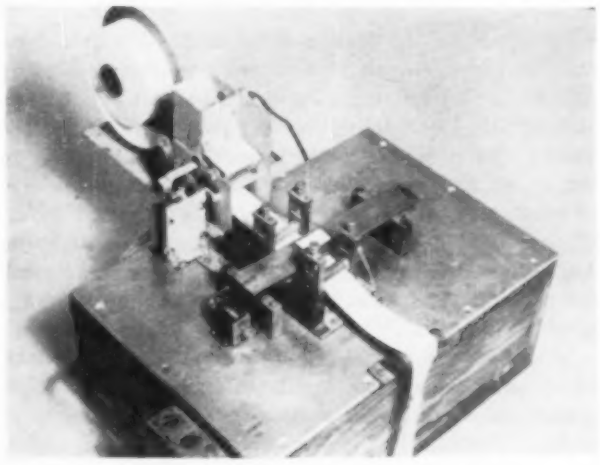


Fig. 2. View of Polaroid Type B Abrader.

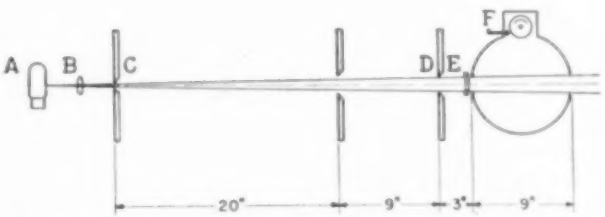


Fig. 3. Cross-sectional drawing of optical system of the Polaroid Type B Haze Meter, showing A—Light Source; B—Collimator Lens; C—Circular Light Aperture; D—Main Light Aperture; E—Specimen; and F—Photocell.

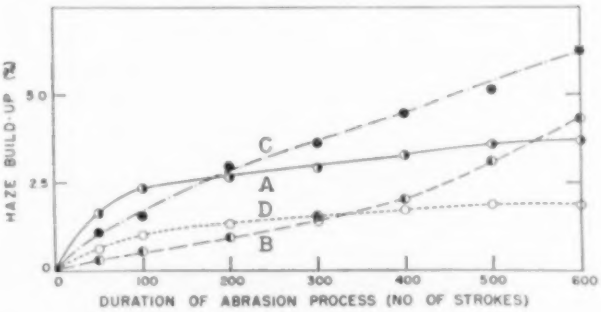


Fig. 4. Effect of abrasion process duration on haze build-up, using 100-gram load, 5.5-inches per second wiping speed, and #300 carborundum as abrasive.

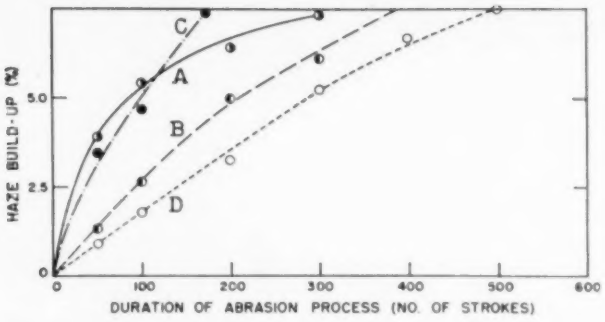


Fig. 5. Effect of abrasion process duration on haze build-up, using 100-gram load, 5.5-inches/second wiping speed, and #300 carborundum as abrasive.

speed of wiping motion, and abrasives of any chemical class and any particle size may be used.

The abrasive powder is fed from a hopper onto a slowly moving cloth tape that is 1.5 inches wide. The tape is cut on the bias, and is faced with flannel on the working side so that it entrains a reasonable amount of abrasive. After receiving its initial load of abrasive, the tape is inverted by running over a roller so that most of the excess abrasive falls off. The remainder of the excess abrasive is shaken off by subjecting the tape to gentle taps from a vibrating blade actuated by an electric buzzer. The tape then is drawn through the abrasion station, past the convex surface of the specimen. Later, it is discarded; neither the tape nor the abrasive is reused.

The specimen itself (i.e., the curved lens) is moved at constant speed back and forth across the tape both transversely and rectilinearly. The total amplitude of motion is one inch. The lens is attached to the underside of its holder by means of double-sided adhesive tape. The holder itself is a rectangular block of metal having a suitably curved, convex underside. The holder is urged downward by means of an adjustable load (a brass block), and is moved back and forth by means of a loose-fitting metal yoke. Below the tape is a stationary opposing block, called the supporting block, that has a cylindrically-curved, concave upper face.

The yoke (a flat bar that is 10 inches long and 1.5 x 0.13-inches in cross-section) is actuated by means of a cam arrangement driven by an electric motor. It can be driven back and forth at any desired frequency from 30-150 cycles (60-300 strokes) per minute. A counter records the total number of strokes. The tape is pulled along by means of two synchronously-geared pairs of spring-loaded pinch rolls placed on either side of the abrasion station. As a result, the tape essentially is tensionless while in this station.

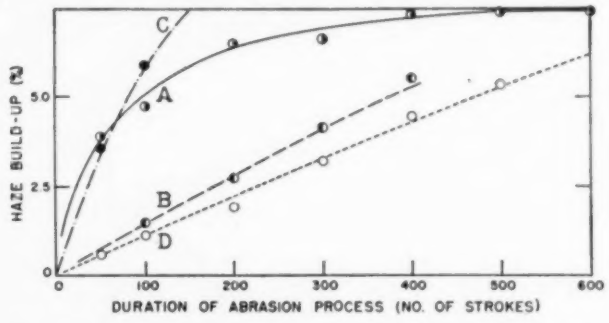


Fig. 6. Effect of abrasion process duration on haze build-up, using 38-gram load, 3.3-inches/second wiping speed, and #300 carborundum as abrasive.

Polaroid Type B Haze Meter

Specimen are appraised both before and after abrasion, by the Polaroid Type B Haze Meter, which measures haze in terms of the amount of white light scattered by the specimen. Figure 3 shows the optical system used. Light from a small tungsten lamp (A) passes through a collimating lens (B), a depolarizing plate, and a series of three circular apertures, the third of which (D) defines the 0.75-inch diameter of the illuminated area of the specimen. The specimen itself (E) is situated just in front of the one-inch diameter entrance port of the nine-inch diameter integrating sphere; the convex side of the specimen being toward the sphere. Diametrically opposite the entrance port is a 1.13-inch diameter exit port provided with a small white plug that is easily removed and reinstalled. When the port is open, the sphere collects just the light that is scattered by the specimen. Light scattered through any angle from 3-85 degrees from the straight-ahead direction is collected.

The photocell (F), situated at the top of the sphere, is a 931-A multiplier phototube equipped with an optical filter that provides an over-all spectral response equivalent to the combination of Illuminant C and the human eye. The anode current is measured by a galvanometer. The instrument is aligned carefully so that the beam passes through the sphere cleanly and the galvanometer reads zero when the specimen and white plug are removed.

To appraise a sunglass lens, the operator mounts the lens in the measurement station, inserts the white plug, and records the galvanometer reading. T_1, which is a measure of the total amount of light transmitted by the specimen. He then removes the plug and reads the galvanometer again. The new reading, T_2, indicates the amount of light scattered into the sphere. The haze of the specimen is defined as T_2/T_1.

Defining Abrasion Resistance

To determine a lens' abrasion resistance, the operator first finds the "before-abrading" haze value, H_0. He then abrades the lens under the conditions chosen, measures the "after-abrading" haze value, H_1. Finally he computes the difference, H_1-H_0, called the "haze buildup."

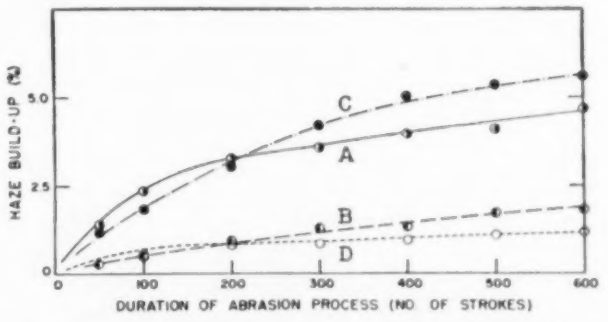


Fig. 7. Effect of abrasion process duration on haze build-up, using 100-gram load, 5.5-inches/second wiping speed, and #600 carborundum as abrasive.

Abrasion resistance is defined as the number of strokes required to produce a haze buildup of 2½% under the specified conditions of load, wiping speed, and abrasive. The 2½% value is arbitrary, but is believed to represent a good compromise between haze values that are so low as to be difficult to measure accurately and those that are so high as to lie outside the range regarded as acceptable by users of sunglasses. Different test conditions, of course, lead to different values of abrasion resistance. The definition rests on no scientific foundation, but is intended merely to facilitate practical comparison of various types of coatings for abrasive resistance.

Materials Tested

In order to narrow down the list of materials showing promise as abrasion resistant coatings, preliminary tests were made on approximately 90 different polymeric materials. Some were procured commercially, while the others were synthesized in our laboratories. Each had been selected because theory or past experience had indicated that it might provide a particularly tough, abrasion-resistant coating.

The two materials appearing best were S-13 and CR-39. Consequently, they were included in the more extensive test series described in the following section. A third type of material, S-10, was included because of its use in the past as a scratch-resistant coating. Plexiglas was included also—not because it showed promise as an abrasion-resistant material—but merely for purposes of comparison. This plastic has enjoyed widespread use in sunglasses, eye shields, camera lenses, and other optical devices.

Table 1 indicates the chemical composition and type of linkage for each of the four materials in question.

Results Obtained

Figure 4 shows the results obtained in the Type B abrader when the abrasive consisted of #300 carborundum, the speed of the wiping motion was 5.5 inches per second, and the load was 38 grams. The haze of each lens was evaluated before abrading and after 100, 200, 300, 400, 500, and 600 strokes of abrasion. Each plotted point represents the average value for four lenses of the given type. The variability found among the four lenses was small; less than about 10% in terms of the haze buildup.

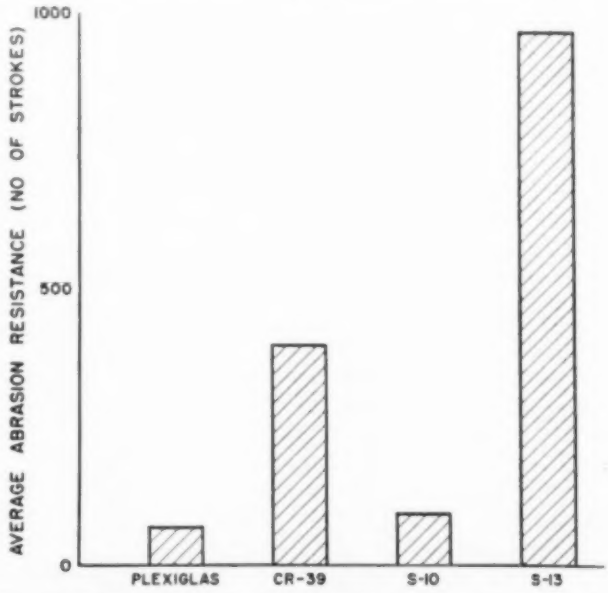


Fig. 8. Comparative "average abrasion resistance" values of four plastic materials.

Two interesting features are apparent. Two of the curves show a tendency to level off, while the other two continue to rise. Also, two of the curves, A and B, tend to cut across each other. These facts suggest that different abrasion mechanisms are involved for some types of lens surfaces, depending on whether the surface is undamaged or has already been damaged severe enough to effect its abrasion resistance.

Curve A, which relates to a linear polymer structure (Plexiglas), rises very rapidly at first, indicating that even a few strokes produce much haze. Thereafter, the curve rises more slowly. Curve B, which relates to the crosslinked polymer (CR-39), rises slowly at first, and then more rapidly. Curve D, relating to the specially-synthesized, crosslinked polymer S-13, rises slowly at first; then almost levels off; and even after 600 strokes the haze value is only 2%.

Figure 5 shows the results obtained when the load is increased to 100 grams. The curves rise much more steeply; roughly three times as steeply as in Figure 4. Again, some curves show large changes in slope and cut across other curves. The relative ranking of the materials remains about the same as in Figure 4.

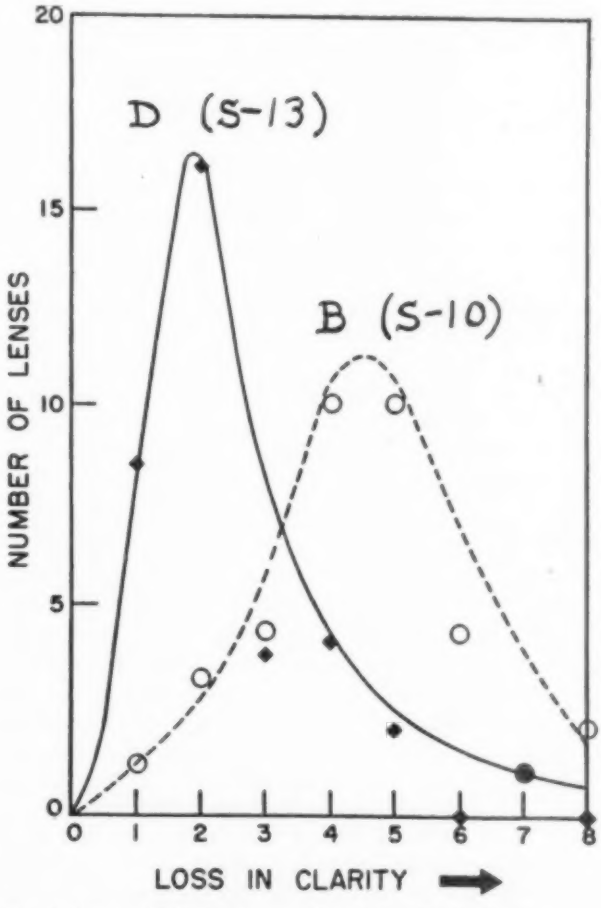


Fig. 9. Loss in clarity of lenses after six-months field use.

Table 1. Surface Materials Tested.

Symbol	Surface Material	Chemical Class	Polymeric-Linkage
A	Plexiglas* (Rohm and Haas)	Polymethylmethacrylate	Linear
B	CR-39 (Columbia Southern)	Allyl diglycol carbonate	Cross-linked
C	S-10** (Polaroid Corp.)	Melamine-formaldehyde polymer	Cross-linked
D	S-13** (Polaroid Corp.)	Dimethacrylate polymer	Cross-linked

*These lenses were homogeneous; i.e., no coating was applied. The lenses were made by employing a six-curve press to mold commercially-prepared flat stock.
**The coating was applied to flat pieces of Kodapak II and curvature was then produced by a molding operation.

Table 2. Abrasion Resistance of Different Surface Materials.

Abrading Conditions			Abrasion Resistance* of Surface Material				See Fig. No.
Load, Gms.	Wiping Speed, In./Sec.	Grit Size	Plexiglas (A)	CR-39 (B)	S-10 (C)	S-13 (D)	
38	5.5	#300	130	430	170	>600**	4
100	5.5	#300	25	90	35	130	5
38	3.3	#300	20	170	30	230	6
100	5.5	#600	110	>600‡	140	>600‡‡	7

*In some instances, the 2½% reference level of haze build-up was not reached even after 600 strokes, when the tests were terminated. Thus no true value of abrasion resistance was determined and only a lower limit was established. In such instances, the symbol ">600" is used.
**The value obtained by graphical extrapolation is approximately 1,500.
‡The value obtained by graphical extrapolation is approximately 900.
‡‡The value obtained by graphical extrapolation is approximately 2,000.

Figure 6 shows the results obtained when the wiping speed is reduced to 3.3-inches per second. Relative to the data on Figure 4, the lower wiping speed causes the haze to increase much more rapidly. After 100 strokes, Materials A and C show haze build-up values of 3-6%, whereas Materials B and D have build-up values less than 2%.

Figure 7, based on the 5.5-inches per second wiping speed and 100-gram load, again shows the superiority of B and D. Even after 600 strokes, the haze build-up of D amounts to less than 1½%.

Table 2 summarizes the results presented in Figures 4-7. It shows, for each of the test conditions, the number of strokes that must be applied to produce a haze build-up of 2½%.

If an average for the four sets of test conditions is computed for each material, the results shown in Figure 8 are obtained. The superiority of the S-13 coating (material D) is obvious; indeed, the S-13 coating surpasses all other coating materials tried by a wide margin, and appears perhaps 10-15 times as abrasion-resistant as Plexiglas, a plastic used in sunglasses made in recent years.

Field Tests

Field tests were made on lenses having the S-10 and S-13 coatings to see whether the large difference implied by the laboratory test results of Table 2 would be borne out in "actual use" tests. Some 100 pairs of sunglasses were prepared and issued to 100 persons, picked essentially at random. These persons were invited to use the sunglasses just as they would any other sunglasses. Each pair contained one lens having the S-10 coating, and one having the S-13 coating. The users were unaware of the fact that the two lenses differed in abrasive resistant coatings.

At the end of two months, 24 pairs were obtained from the users and were reappraised. The S-10 coatings showed much damage, while the S-13 coatings showed little damage; so little, in fact, that the decision was made to postpone any large-scale comparisons until six months had elapsed.

At the end of six months, 35 pairs of sunglasses were obtained from the users and were reappraised carefully. The appraisal method, like the field tests themselves, was intended to simulate actual use. The observer looked through the lens in question toward a relatively dark field of view while a spot-light, situated just outside the field of view, shone on the lens. This was done to simulate the effect of direct sunlight. The observer then judged the loss in clarity of the lens in comparison to that of a brand-new lens. His opinion was recorded as a number from 0-8, thus:

Rating	Loss in clarity
0	None
1	Trace
2	Slight
3	Slight to moderate
4	Moderate
5	Moderate to large
6	Large
7	Very large
8	Complete

The scale, of course, is entirely arbitrary, and the precision of the rating probably is not high. A gratifying degree of agreement, however, was found between appraisals made by different persons. The scale covers a great range in loss of clarity; a far greater range than the numbers 0-8 suggest. Each step (after "step 1") corresponds roughly to a factor of perhaps 1.5 in loss of clarity relative to the preceding step. Thus, the scale is logarithmic in character.

No photoelectric measurements of haze were made on these lenses. So many kinds of damage were evident

(Continued on page 152)

PAUL E. FINA,
Director of Sales Engineering,
The Fiberite Corp., Chicago, Ill.

Let's *SELL* Thermosets

SOME of the recent editorials published in PLASTICS TECHNOLOGY have been critical expoundations on the reasons for the present 'ailment' in the thermosetting field (especially phenolics.) In my Guest Editorial, "How to Avoid Plastic Misapplications" (Feb. 1957), one of the points stressed was that a sound and basic knowledge of available materials is a postive need. Many of the molder's salesmen are not educated properly. Too, the thermoset molders are stressing the fact that the thermoplastics molders are beating their time. I say "kwitchurbelyakin" and put out some educated salesmen that know when the thermoplastics are wrong for the application. Actually, what thermoplastic material can give the composite advantages of any of the thermosetting materials?

Mr. N. W. Oberle, of Baker Brothers, says faster production methods for thermosets are needed. Mr. John H. Woodruff, of Auburn Plastics, says that the molder is spending his money for injection equipment, and that the automatic compression equipment belongs in the captive plant. Mr. P. R. Young, of Wallace and Tiernan, Inc., says that there is a need for proper molder education.

I agree with all these men. But again I say, let us get that salesman out and make sure he knows the advantages of thermosetting over thermoplastics. Remember that he is the contact man and what he says has much to do with the type of material used. He must recognize the thermosetting applications.

Fiberite spends a lot of time in personal contacts with molder's salesmen and the end-user. It becomes apparent very quickly just where the honest job is done. In the course of a month more than a hundred inquiries come through our hands. These inquiries give us the pulse of the industry. We have testimonials from end-users showing their dissatisfaction with injection materials. Among the complaints are: poor dimensional stability; distortion at low temperatures; brittleness of some of the less-expensive thermoplastics; soft or easily scratched surfaces; and high stretchability (elongation.) Obviously, someone gave the end-user bad advice.

It is true that some of the thermoplastics applications are blessings to mankind. One sees good examples of polyethylene in use in all sizes of containers. The acrylonitrile-styrene alloys are wonderful for cases and housings. The acrylics produce jewel-like parts. But when it comes to industrial applications, precision parts, structural devices, heat-resistant requirements, and equipment that is subject to wear, weather and work, the thermosets should come first in choice.

Reasons for using thermosetting materials (primarily phenolics) are:

(1). Best possible dimensional stability.

(2). Highest possible heat resistance of the organic plastics.

(3). Closest tolerance molding, especially phenolic-glass.

(4). Durability of molded product.

(5). Hardest wearing surface, especially melamines.

(6). Minimum cold flow, elongation or deformation.

(7). Negligible deterioration of part after years of use.

(8). Controllable shrinkage.

No thermoplastic compound can make all these claims!

Industry has a great need for the thermoset materials. The salesman who cannot get beyond the purchasing agent and to the engineers is not a qualified man to do the creative work that is essential for the growth of the thermosetting plastics industry. To get past the purchasing agent, the salesman must show that he merits the honor by having a sound and basic knowledge of the materials available. So molders, if you want more thermosetting work, look at your salesmen!

—THE END

J. A. STIFTER, *Pres.*
Milburn Company
Detroit, Mich.

A Control Program for Epoxy-Caused Dermatitis

The hazards and causes of irritant and allergic dermatitis are discussed, and an effective plant control program is presented.

THE epoxy resins are a wonderfully useful and versatile family of materials, with a future that undoubtedly will be even more spectacular than their present status. They have one specific property, however, that must be recognized and prevented.

They or, more frequently, the agents used in their cure are capable of producing a distressing dermatitis. In this respect, of course, expoxies are no different (or different only in degree) from a great many chemicals in common industrial use. They simply are newer, and they are penetrating industries and departments which have had little previous experience with irritating materials.

The Disease

Two kinds of dermatitis may result from exposure to the epoxies and their hardeners. One is a primary contact dermatitis due to the irritant action of the chemicals. In a typical case, red patches about the size of a coin appear on the underside of the forearms, on the fingers and back of the hands, and sometimes on the face and neck. These patches itch intensely.

The second, usually occurring after an irritant dermatitis has been permitted to continue uncorrected, is a sensitization or allergic dermatitis. In a typical case, there is severe inflammation all around the eyes and sometimes over the entire face. The hands and forearms also may be affected with swellings and blisters that itch severely. It usually is impossible for a man to work when this attack is at its peak.

If proper measures to control the exposure to the irritating chemicals are instituted, workers who have this sensitization dermatitis may overcome it with time. Persistence if the dermatitis usually is a sign that contact with the irritants still continues in some form. However, a few workers may remain highly sensitized. Any further exposure, however slight and harmless to a normal person (sometimes merely inhaling the vapor from an uncorked vial), may bring a recurrence of the symptoms. These highly sensitive people may require a transfer, at least temporarily, to another kind of job.

The epoxy components, as well as other industrial chemicals, appropriately may be compared to poison ivy. They are alike in their ability to cause both irritant and allergic types of dermatitis, and to leave the subject more vulnerable to each succeeding exposure. One other point of resemblance of epoxy system components and poison ivy may be stressed in worker education. They are not poisons that attack the system. The distress they may cause is confined to irritations of the skin.

The dermatitis that may be caused by epoxies or hardeners has certain other special characteristics that should be taken into consideration when planning a control program:

(1). The symptoms of the allergic or sensitization form usually are delayed in their onset, and give no advance warning. You may work around epoxies, doing all the wrong things, for several weeks with apparent immunity. Then, usually after about three to five weeks (although, in some cases, the interval may be as little as one week or as long as several months), the swelling and itching of sensitization dermatitis suddenly break out.
(2). By the time the symptoms are first reported or recognized by a responsible person, the worker often has become highly sensitized to the irritating chemicals.
(3). The dermatitis does not strike only allergy-sensitive individuals. Some of the amines used as epoxy hardeners are capable of producing dermatitis and sensitization in almost any individual.

Partly because of these factors, the incidence of dematitis among epoxy workers may reach very high levels; sometimes high enough to adversely affect production. The heaviest rates seem to be reported from jobs where large or predominantly unskilled work forces are employed, or from smaller plants where managements are unaware of the need or the technique for control.

Any company that is willing to make the effort and learn the rules can control the dermatitis problem. It is not always possible to eliminate the problem completely, and an occasional case still may occur, particularly among large work forces. With controls, however, those cases which do occur will be much less severe; there will be no mass outbreaks; and there will be virtually no sensitization cases.

The first case of sensitization dermatitis may be taken as a sign that proper handling procedures are not being observed.

The Hazards

Much of the material that has been written about dermatitis among epoxy workers has focused on the hazards of the amine curing agents. Actually, every known component of epoxy systems, with but one exception, has its own degree of hazards. It is true the gradation may be as much as 20:1 or more between one of the highly irritating components (such as diethylene triamine) and one of the less irritating curing agents (such as phthalic anhydride).

This gradation is the proportion between the number of individuals who are capable of developing dermatitis after excessive exposure to one or the other of these two chemical types. In practice, however, this distinction is of little help. Since it is impossible to discover in advance who the sensitive individuals in a work group may be, the same precautions must be observed for every component and every individual.

The components of epoxy systems may be graded roughly in terms of potential hazard in the following order:

(1). The fast-curing high volatile liquid amines; e.g., diethylene triamine.
(2). The higher molecular weight, less volatile free amines; e.g., triethylene tetraethylene pentamine.
(3). Styrene oxide reactive diluent.
(4). Other reactive diluents, such as allyl glycidyl ether and phenyl glycidyl ether.
(5). Liquid epoxy resins.
(6). Partially formulated or adduct types of curing agents; e.g., Epon Curing Agent U, Bakelite ZZL-0801.
(7). Acid anhydride and amine salt curing agents; e.g., phthalic anhydride, Epon Curing Agent D.
(8). Solvents such as methyl isobutyl ketone and xylene that are used sometimes in epoxy formulations.
(9). Cured epoxy compounds (nuisance hazards in grinding and finishing only).
(10). Solid epoxy resins (believed hazard-free).

In amplification of the above, all free amines (components 1 and 2) are strong caustics, and can cause an alkaline burn on direct contact. If a drop splashes into the eye and is not washed out immediately, it will cause severe damage. Exposure to high vapor concentrations produces irritation of the eyes and mucous membranes. Exposure to the free amines also is more likely to cause sensitization dermatitis than do other epoxy components. Repeated exposure to their vapors may do the same.

All the reactive diluents (components 3 and 4) used with epoxies are classified as mildly to severely irritating materials. On excessive contact, they produce an irritant dermatitis which can develop into a sensitizaton dermatitis with the same symptoms and course as the amine sensitization.

Prolonged and frequent direct contact with the liquid epoxy resins (component 5) will produce a contact dermatitis, and also may cause a sensitization. The lower the molecular weight of the liquid resin, the greater its capacity to produce dermatitis.

The toxicity of adduct curing agents (component 6), in which free amines are partially combined with epoxies, is below that of either of its two adduct components. The hazard of vapor exposure is largely eliminated. Excessive direct contact, however, will produce dermatitis, and sensitization also may occur.

The anyhydrides and amine salts (component 7) are only moderately irritating, and, are less likely to cause early senstization than do other curing agents.

Ketones and similar organic solvents (components 8) are primary skin irritants because of their ability to dehydrate and remove natural oils and fats from the skin. Although they do not cause sensitization themselves, they make the skin more vulnerable to attack by the more potent curing agents or liquid resins.

Cured epoxy compounds and solid epoxy resins (components 9 and 10) may be encountered by using contaminated tools, rags, or hardware, through prolonged exposure to vapors, or by contacting dust from grinding. They may be locked on the skin by putting on gloves or barrier creams over soiled hands.

The Approach

Some of the means of education on control of epoxy dermatitis include meetings with supervisors or work crews, distribution of technical bulletins to supervisors, and bulletin board notices.

Typically, a company's instruction program on epoxy hazards is focussed on its supervisors and foremen. They, in turn, are relied on to instruct and control the workers in their charge. This approach works best in departments with an established pattern of strong safety discipline or exacting work standards.

Our experience, and that reported to us by public health industrial hygiene officers, would indicate that a supplementary educational effort, directed at the individual workers, is desirable when one or more of the following seven conditions prevails:

(1). Work forces using epoxies are large.

(2). Workers have limited previous industrial experience.

(3). Workers are largely unskilled.

(4). Work groups are extremely heterogenous in composition.

(5). The company has no industrial hygiene department of its own.

(6). Working discipline tends to be lax.

(7). Rumors about the dangers of hardeners and epoxies are circulating.

The need for education is not confined to workers and supervsors. Many managements lack adequate information on the health hazards resulting from careless handling of epoxies.

Company Housekeeping

For good company housekeeping, the contaminating materials should be confined to epoxy work areas that are kept separate from the rest of the plant. Plant traffic through these areas should be restricted or even eliminated if at all possible. However, isolation and control can best be maintained if these epoxy areas are kept relatively small. In plants which employ very large numbers on work with epoxies, it may be advisable to set up serveral separate epoxy areas.

Workers who go from these epoxy work areas to other parts of the plant should remove their gloves and aprons and wash their hands each time. Negligence in this respect is an easy way for epoxy workers to build up their exposure past tolerable limits, as well as to spread the contamination to other workers. Soiled gloves, aprons, etc. will contaminate doorknobs, stair rails, etc., against which workers will brush repeatedly with unprotected hands and arms.

Equipment, such as hand trucks, drums, etc., for epoxy-using departments should not be shared with other departments.

The foregoing rules should be observed with special strictness by the departments which formulate epoxy-amine mixtures.

Fig. 1. Epoxy-hardner mixtures at Stellar Engineering Co., Detroit, are formulated in central supply crib only, using disposable containers, paddles, wipers, and automatic shot dispenser.

Epoxy resins, amines, and formulations should be stored in tight, sturdy containers, preferably in a separate stockroom (see Figure 1.)

Avoid contamination of clothing and work surfaces. Spread disposable paper, such as butcher paper, on workbenches and on the surrounding floor see Figure (2.) These papers should be replaced twice a day. Supply clean rags daily, and discard them as soon as used by emptying into a closed container.

Use of solvents should be avoided as much as possible. Do not dip-clean epoxy spattered tools, etc., in containers of solvent that then will be used for other cleaning jobs. Epoxy compounds should be mixed in disposable cardboard containers of ample size and having spouts to minimize dripping. Disposable spatulas are recommended. Finally, aisles and workbenches should be kept clean and orderly.

Need for Ventilation

Formulate epoxy compounds in a local exhaust-ventilated area with bench-type hoods. Exhaust velocities equal to 100 cubic feet per minute are recommended. Curing also should be conducted in exhaust-ventilated equipment.

Lay-up work should be conducted in areas provided with good general air circulation (five changes of air per hour.) The air from these areas should not be recirculated. Grinding and finishing operations on cured products should be in local exhaust-ventilated areas; a down-draft is preferable.

Personal Worker Cleanliness

The hands and skin must be kept clean. A thorough wash-up before lunch and at quitting time is only a minimum. Hands should be washed thoroughly both before and after work, and before all reliefs, lunch breaks, or other interruptions. In addition, they should be washed before applying skin creams or gloves.

Hands should be washed immediately after any hardener or resin has touched the skin, without waiting for

the regular wash-up period. A drop of epoxy or hardener falling on the skin air-cures in minutes, and then will be extremely hard to wash out. A wash-up after every lay-up also is desirable on many jobs.

Wash-up facilities should be provided adjacent to the work. If regular washroom facilities cannot be installed at the work area, workers should be supplied with a suitable waterless cleaner (see Figure 3.)

For washing, a mild soap (without abrasive scrubbers) or a waterless cleaner that is low-alkaline or neutral (and does not contain appreciable amounts of petroleum solvents or defatting agents.) Alcohol may be used to remove epoxy or hardener drops that have air-cured on the skin, and are difficult to wash off by normal means. This should be followed by a soap-and-water wash or waterless cleaner.

Fingernails should be kept short and clean. Solvents should not be used to clean the hands or clothing, and only clean clothing and gloves should be worn.

Protective Creams & Clothing

Protect the skin with barrier creams. A film-forming skin cream, such as Milburn Ply No. 9 Gel, should be applied on the fronts and backs of the hands, forearms, and neck, and on the face. A cream that depends on the protective effect of emulsified oils or fats will not be effective, since these are soluble in organic solvents. The cream should be applied at start of the work shift and before each return to work after reliefs, lunch breaks, wash-ups, etc.

The barrier cream must be washed off at lunch, quitting time, etc. This is the equivalent of removing the work gloves before going out of the department. A barrier cream will not protect over dirty hands so that hands, arms, etc. should be washed thoroughly before applying. When working with water-based liquid hardeners, provide a water-insoluble skin cream (such as Milburn Ply No. 3 ointment.) After final wash-up, workers should rub in an emollient cream (such as Milburn Plyothol) to counteract the drying and defatting action of the epoxy hardeners and solvents.

Barrier creams should be dispensed in individual portions, in whatever form is most convenient for use under the particular conditions of the job. Workers should not be allowed to use a common jar. Of course, there should be a follow-through to make sure that the creams are being used, and used properly.

Protective clothing should start by having the workers change coveralls and aprons frequently. If soiled or spilled on before the regular change day, the coveralls and aprons should be changed at once. Coveralls or shirts should be worn with long sleeves. A very light sleeve of plastic or impervious fabric may be worn over shirt sleeves to protect the forearms. Sleeves should be washed daily. Tattered or torn protective clothing should not be worn.

Where there is danger of eye splashes from amines, face shields or goggles should be provided. Gloves should be rubber or plastic-coated and cotton lined. Gloves must be worn for all cleaning jobs, and for any use of solvents.

Gloves should be worn, in addition to barrier creams, for mixing, laying-up, curing, and all other epoxy operations where they are practical and will be tolerated. The gloves should be washed daily while on the hands, using soap and warm water. Solvents should not be used to clean the gloves. Contamination of the inside the glove should be avoided when removing them. The safe way is to remove gloves by pulling at the fingers. The gloves should not be worn over dirty hands.

Fig. 2. Where epoxy lay-ups require hand shaping to intricate contours, as with this gas tank by Stellar Engineering Co., Detroit, workers can dispense with gloves and protect hands with buffer creams and frequent wash-ups. Crouching worker wears plastic sleeves to prevent contact with contaminated apron. Man in background is applying buffer cream from individual container before returning to work. Note butcher paper on floor to catch droppings, and the disposable containers for epoxy mixtures.

Program Follow-Through

The above recommendations are not self-enforcing, and will require follow-through and supervision to make sure that protective measures are applied properly. They may call for imagination in adapting a general rule to the specific job and the crew of people in your plant. Without these rules, using gloves or barrier creams may do more harm than good by lulling man-

(Continued on page 148)

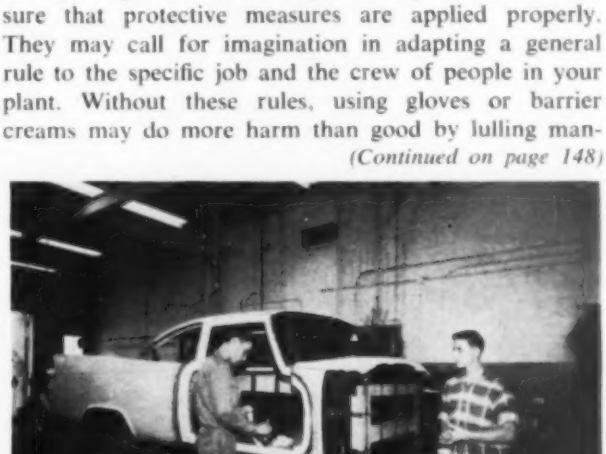
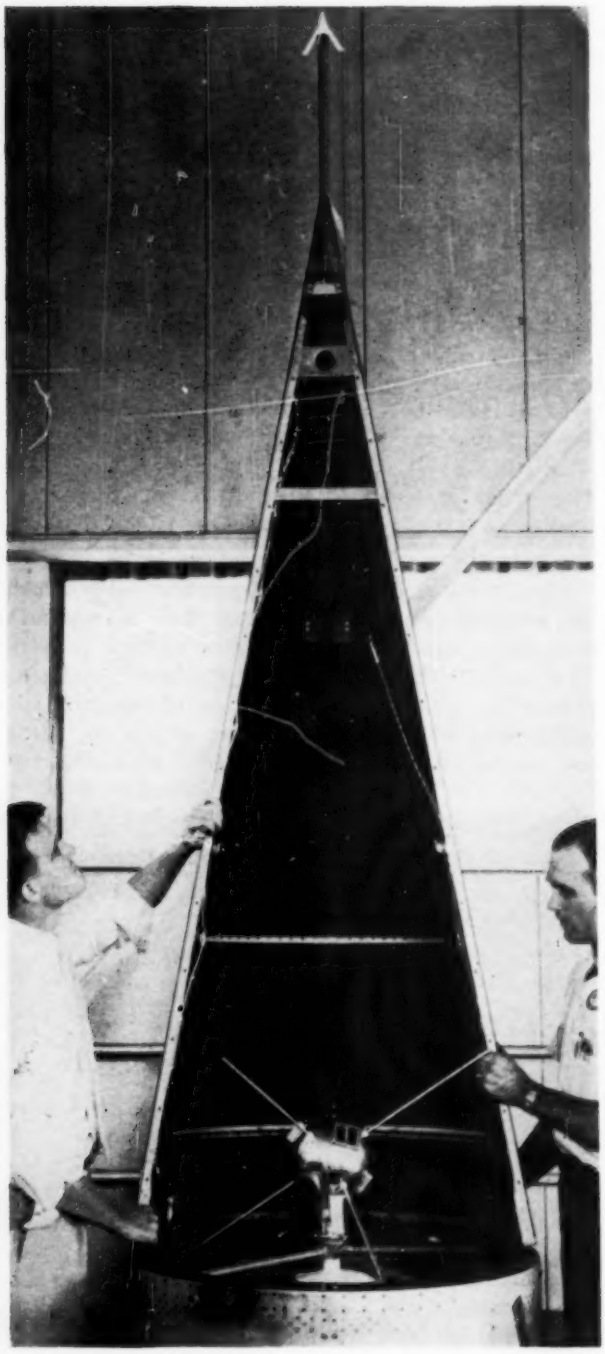


Fig. 3. Workers may dispense with gloves on lay-ups with delicate radii if they use buffer cream, and wash after every lay-up. If washing facilities are distant, a non-irritating, waterless hand cleaner can be supplied in individual containers.

Plastic Nose to Guard U.S. Satellite in Flight



Half of phenolic plastic nose cone shell being inspected.

When the Vanguard rocket launches another American satellite into outer space, the rocket nose cone that will protect the satellite during ascent will be of asbestos-reinforced phenolic plastic material developed by the Reinforced Plastics Dept., Raybestos-Manhattan, Inc., Manheim, Pa.

The nose cone will be approximately 6½ feet long and 30 inches in diameter at the base, and will be tipped with a point of solid titanium. The function of the nose cone will be to streamline the rocket and insulate the enclosed satellite from friction-generated heat in its upward flight that will reach an altitude of 300 miles and a speed of about 18,000 miles per hour. The nose cone also will protect the 72-foot rocket from ram effect caused by aerodynamic loading while the rocket is in motion through the air.

The reinforced plastic material used for the cone is R-M's Pyrotex felt, Style 41-RPD. This material was selected because of its low weight, and its ability to retain strength at temperatures above 1,000° F. It weighs 0.065 pounds per cubic inch, as compared to 0.10 for aluminum, 0.17 for titanium, 0.28 for steel, and 0.32 for nickel. In addition to high strength: weight ratio, the material has extremely high modulus (stiffness) of elasticity at both low and elevated temperatures and resistance to blistering, delamination, and erosion when subjected to high temperature and thermal shock.

The cone is molded by Martin Co. in two parts so that it can split apart and drop off when the rocket is above the densest part of the atmosphere. It will be jettisoned early in the second stage of the rocket's flight when the air thins out and skin friction subsides.

R-M's Reinforced Plastics Dept. also has supplied other parts, such as conduits and thermal insulators, for the Vanguard, and R-M supplies materials for the Titan I.C.B.M., the Tartar and Terrier missiles, the Sidewinder, and the Polaris Intermediate range ballistic missile.

—THE END

W. G. MURRAY, *Plastics Lab. Technician,*
and
G. A. STEIN, *Director of Plastics Research,*
A. O. Smith Corp.
Milwaukee, Wisc.

Evaluating Epoxy Resin Degradation Systems

A test method is described that gives duplicable measurements of the effects of various exposure media on resins with different curing systems

THE purpose of this article is to present data compiled in our laboratories concerning the absorption-decomposition characteristics of various epoxide blends. More specifically, this paper deals with the effects of long-time exposure under various conditions on fiber glass-reinforced plastics produced from these resin blends.

A test was devised to simulate actual use conditions for reinforced plastic pipe. This test method does not attempt to cover the numerous conditions that could exist in the broad applications for reinforced plastics. The solutions used were chosen to be sufficiently general to allow estimation of the potential effect of long-time exposure.

Before discussing the test procedure, methods, and equipment used in the test, it is in order that certain terms be defined.

Firstly, the "Resin Degradation Test" referred to in this paper is that test originated in our laboratories for the express purpose of gaining information on the effects of various exposure media on epoxide resin blends and fiber glass-reinforced pipe samples.

Second, curing agent m-phenylenediamine will be referred to as "CL"; the boron trifluoride monoethanolamine complex as "BF_3 Complex"; and "Chlorendic" or "Het" anhydride as "CHLA."

Test Procedure

The resin degradation test devised was as follows: Two types of samples were prepared and weighed dry. These samples then were placed in bottles containing various exposure media. These exposure media were selected to simulate conditions under which end-items might be exposed. The jars containing the samples and solutions then were placed in a water-bath held constant at 170° F. These samples were removed periodically and weighed. The average weight gain or loss of each sample type was recorded, and the variations were plotted.

Separate batches of an epoxide resin were cured with 14.5 parts per hundred of "CL," three parts per hundred of "BF_3 Complex" and 100 parts per hundred

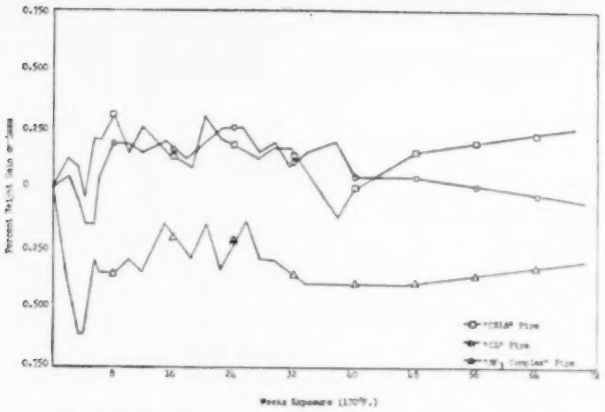


Fig. 1. Pipe Samples Immersed in Transformer Oil.

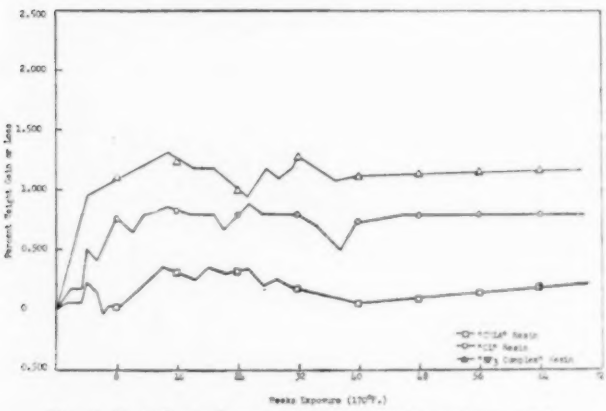


Fig. 2. Cast Resin Samples Immersed in Transformer Oil.

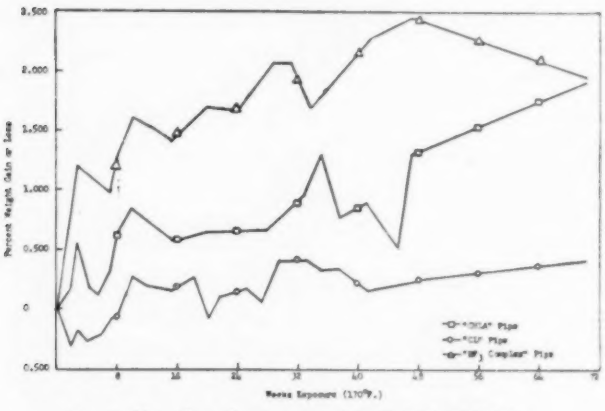


Fig. 3. Pipe Samples Immersed in Deionized Water.

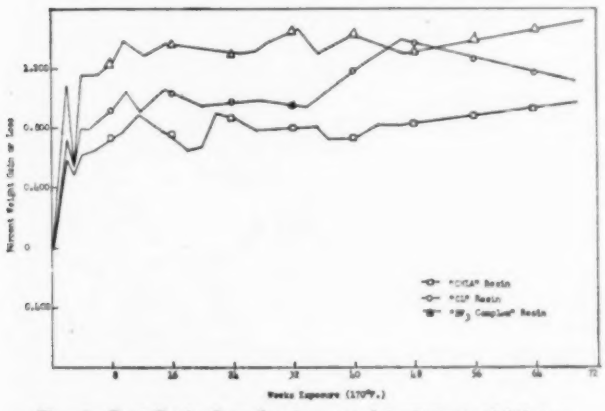


Fig. 4. Cast Resin Samples Immersed in Deionized Water.

of "CHLA." These curing agent concentrations were calculated to be stoichiometrically equivalent to the epoxide equivalent of the resin used, with the exception of the "BF_3 Complex" which functions catalytically.

The two types of samples used for testing the susceptibility of the previously mentioned resin systems were: (1). cast resin samples poured into two-inch diameter aluminum dishes approximately ¼-inch deep; and (2). one-inch sections of two-inch diameter pipe reinforced with glass fibers.

The cure cycles for the two types of resin samples were chosen to approach their optimum physical properties, as follows:

(A). Epoxide resin plus 14.5 pph. "CL" cured for two hours at 250° F.

(B). Epoxide resin plus three pph. "BF_3 Complex" cured for one hour at 300° F.

(C). Epoxide resin plus 100 pph. "CHLA" cured for one hour at 300° F.

The five media chosen for the resin degradation test were: transformer oil (also used as an insulator in electrical conduit), pH_2, water (a strongly acidic solution), pH_{11} water (a strongly basic solution), deionized water (neutral pH), and moist air.

Throughout the entire test, the samples were weighed in deionized water in an analytical balance to an accuracy of 0.01 gram. The samples immersed in transformer oil were weighed in transformer oil. By weighing the samples "in solution" and by taking the average weights of several samples, the inaccuracies caused by attempting to dry the sample surface were eliminated so that more accurate measurements could be made.

Test Results

The average percent weight gain or loss was plotted graphically versus exposure time. The percentage change was computed by dividing the weight change by the initial dry weight. The cast resin samples and the reinforced pipe samples of the three resin systems immersed in the same media were plotted separately to allow comparison of the resin systems. (see Figure 1-10).

Tables 1-5 give the percent weight changes of the samples, and the two sample types immersed in the same media are contained in the same table. These data were analyzed with visual and microscopic examination

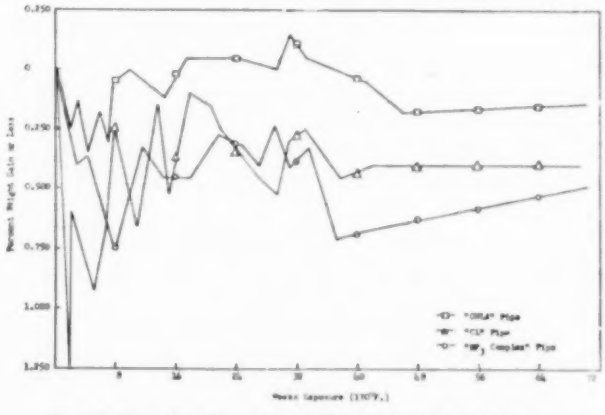


Fig. 5. Pipe Samples Immersed in pH_2 Water Solution.

of the samples. These data also show how the various exposure media affect the resin systems and sample types used.

In examining the data on the resin system using an epoxide resin plus 14.5 pph. curing agent "CL" (Figures 1 and 2, and Table 1) there are definite indications that a change is taking place following exposure. The changes in the two types of samples immersed in the five solutions, however, vary with the sample type and exposure medium. The cast resin samples immersed in the media (Figure 2, 4, 6, 8, and 10) show a definite gain in weight of approximately 1%. On the other hand, the pipe samples (Figure 1, 3, 5, 7, and 9) show a loss in weight. It may be noted that the pipe samples immersed in transformer oil (Figure 1), deionized water (Figure 3), and pH_{11} water (Figure 7) do not show as severe a weight change as the samples immersed in pH_2 water (Figure 5) and moist air (Figure 9).

When examining the two sample types under a microscope, there are definite signs that the cast resin samples are absorbing their exposure media by the presence of these media in small air bubbles contained in the samples. The pipe samples show that there is a definite breakdown in the pipe wall, and the exposure media are attacking either the glass fiber or the cured resin. The former seems more than likely to be the answer because the cast resin samples of the same resin system exposed in the same media show a gain in weight. Here, again, the various exposure media have varying effects on the samples. Assuming that the glass fibers are being attacked by the exposure media, it may be seen that the glass is least affected by transformer oil and deionized water, but that the basic solution (pH_{11}), the acidic solution (pH_2), and the moist air have greater effects on the glass fibers.

Examining the data for the resin system using three pph. "BF_3 Complex" as a "catalyst," it can be seen that there also is a varying effect on the two types of samples due to the exposure media. In some cases, there is a gain in weight; in other cases, there is a loss in weight.

The cast resin samples immersed in the five media again show definite gains in weight, indicating that this resin system also is absorbing the various media. The average absorption is approximately 1.2%. The pipe samples were affected differently than the cast resin samples. The samples exposed in transformer oil, pH_2

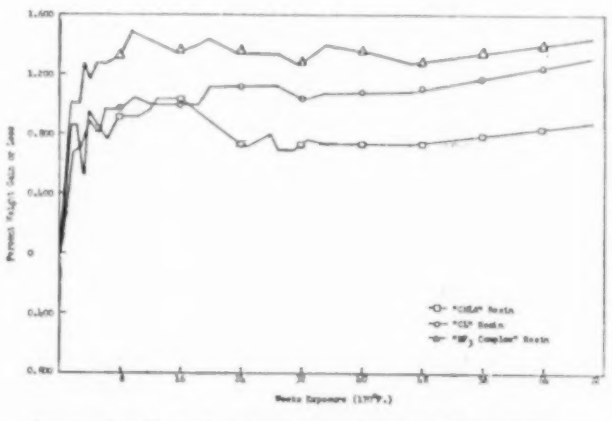


Fig. 6. Cast Resin Samples Immersed in pH_2 Water Solution.

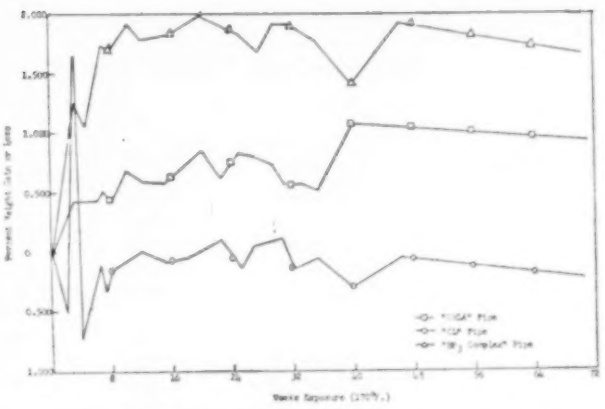


Fig. 7. Pipe Samples Immersed in pH_{11} Water Solution.

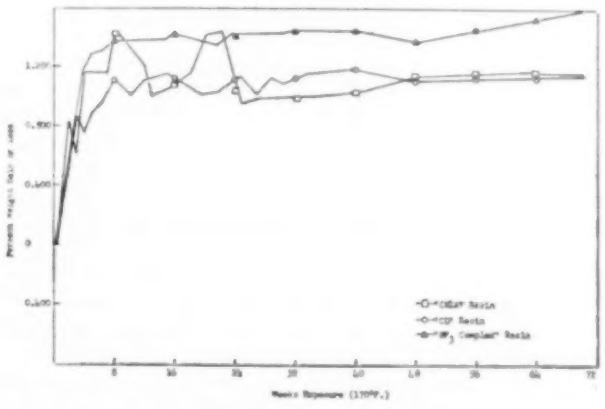


Fig. 8. Cast Resin Samples Immersed in pH_{11} Water Solution.

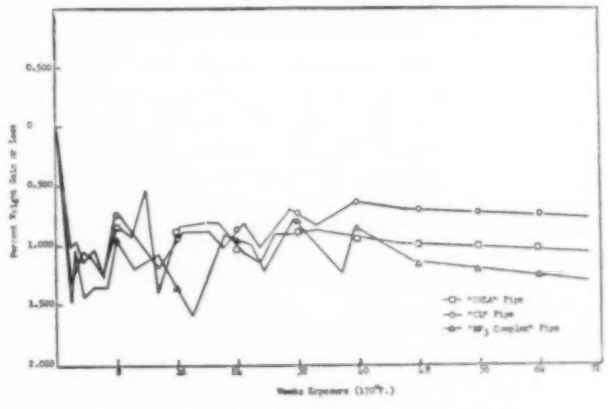


Fig. 9. Pipe Samples Immersed in Moist Air.

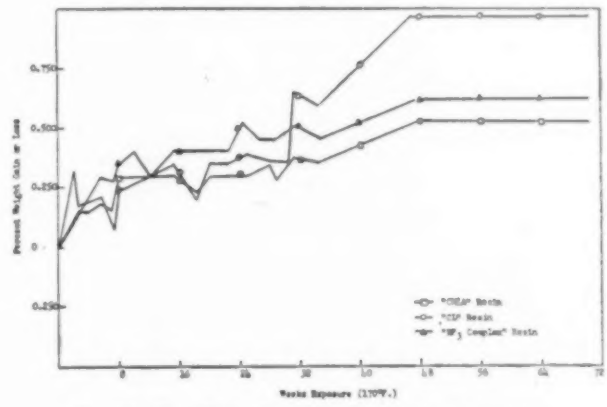


Fig. 10. Cast Resin Samples Immersed in Moist Air.

Table I. Percent Weight Change Of Samples Immersed In Transformer Oil

Exposure Time, Weeks, @ 170° F.	"CL" Cures		"BF_3" Cures		"CHLA" Cures	
	Pipe Samples	Resin Samples	Pipe Samples	Resin Samples	Pipe Samples	Resin Samples
2	0.048	0.178	—0.400	0.496	0.130	0.066
3	—0.047	0.178	—0.664	0.091	0.090	0.067
4	—0.142	0.506	—0.664	0.939	—0.048	0.221
5	0.142	0.430	—0.300	0.787	0.213	0.142
6	0.048	0.532	—0.349	0.610	0.208	—0.042
8	0.190	0.759	—0.349	1.133	0.295	0.014
10	0.142	0.632	—0.300	—	0.168	—
12	0.090	0.785	—0.349	1.210	0.253	0.221
15	0.190	0.860	—0.141	1.305	0.170	0.360
18	0.090	0.790	—0.300	1.171	0.128	0.243
20	0.189	0.784	—0.141	1.184	0.293	0.348
22	0.230	0.632	—0.349	0.922	0.213	0.302
25	0.230	0.835	—0.139	1.186	0.173	0.346
27	0.142	0.806	—0.300	1.126	0.130	0.220
29	0.189	0.809	—0.300	1.187	0.173	0.243
31	0.095	0.785	—0.400	1.133	0.165	0.177
33	—0.142	0.707	—0.400	1.070	0.003	—0.022
35	—0.189	0.506	—0.612	1.070	—0.120	—0.110
40	0.046	0.735	—0.498	1.125	0	0.067
46	0.047	0.811	—0.397	—	0.160	0.091
65	0.167	0.785	—0.296	1.170	0.120	0.221

water, and moist air showed a loss in weight, while the samples exposed in deionized water and pH_{11} by water showed a large gain in weight. The pipe samples immersed in deionized water showed a gain of 3.1%, while the samples immersed in pH_{11} water showed a gain of 1.9%.

When observing the "BF_3" cured cast resin and pipe samples microscopically, it again could be noted that absorption and decomposition were taking place. However, the exposure media affected the samples differently than they did the resin system using "CL" as a curing agent. In this case, the transformer oil and pH_2 solution caused decomposition; deionized water, pH_{11} water, and moist air were absorbed by the pipe samples, and exposed fibers could be seen easily in the pipe samples after nine months exposure. All the cast resin samples had the "media" contained in their occluded air bubbles.

It then follows that a general statement may be made regarding the resin system using the "BF_3 Complex," as a "catalyst," as follows: The system epoxide resin plus three pph. of "BF_3 Complex," when exposed for an extended period of time in various media, either will absorb the media, or the media will attack the resin system and decomposition occur. In addition, these changes are more severe than those occurring when reactive "curing agents" are used.

The data for the resin system using an epoxide resin

Table 2. Percent Weight Change Of Samples Immersed In Deionized Water

Exposure Time, Weeks, @ 170° F.	"CL" Cures		"BF_3" Cures		"CHLA" Cures	
	Pipe Samples	Resin Samples	Pipe Samples	Resin Samples	Pipe Samples	Resin Samples
2	—0.338	0.732	0.902	1.114	0.166	0.167
3	—0.186	0.587	1.189	0.375	0.551	0.526
4	—0.371	0.810	0.580	1.165	0.168	0.627
5	—0.239	0.810	0.726	1.171	0.127	0.666
6	—0.097	0.926	0.956	1.218	0.293	—
8	—0.093	—	1.182	1.380	0.508	0.708
10	0.273	1.084	1.575	1.305	0.827	0.942
12	0.185	0.955	1.544	1.383	0.720	0.812
15	0.143	1.080	1.393	1.335	0.505	0.663
18	0.234	1.013	1.545	1.325	0.595	0.678
20	—0.094	0.942	1.700	1.325	0.637	0.946
22	0.091	0.968	1.645	1.305	0.642	0.911
25	0.137	0.995	1.847	1.335	0.642	0.783
27	0.046	1.006	1.948	1.383	0.748	0.769
29	0.419	0.969	2.054	1.455	0.957	0.807
31	0.419	0.942	2.156	1.305	1.139	0.801
32	0.323	0.955	1.678	1.258	0.763	0.745
35	0.339	1.008	1.935	1.315	0.894	0.745
40	0.142	1.189	2.286	1.406	0.998	0.811
46	0.238	1.137	2.442	1.406	1.331	0.811
65	0.419	1.100	1.985	1.515	1.997	0.977

Table 3. Percent Weight Change Of Samples Immersed In pH_2 Water

Exposure Time, Weeks, @ 170° F.	"CL" Cures		"BF_3" Cures		"CHLA" Cures	
	Pipe Samples	Resin Samples	Pipe Samples	Resin Samples	Pipe Samples	Resin Samples
2	—0.581	0.689	—1.277	1.025	—0.261	0.853
3	—0.402	0.713	—0.712	1.080	—0.133	0.532
4	—0.369	0.873	—0.926	1.273	—0.354	0.968
5	—0.541	0.805	—0.767	1.160	—0.178	0.833
6	—0.746	0.942	—0.665	1.273	—0.311	0.776
8	—0.491	0.942	—0.255	1.273	—0.037	0.918
10	—0.313	1.037	—0.668	1.320	—0	0.918
12	—0.447	1.106	—0.152	1.465	—0.037	0.943
15	—0.536	1.055	—0.515	1.410	—0.135	1.056
18	—0.447	1.080	—0.102	1.340	—0.037	1.029
20	—0.358	1.130	—0.152	1.378	—0.043	0.968
22	—0.269	1.130	—0.255	1.423	—0.041	0.883
25	—0.318	1.106	0	1.376	—0.043	0.781
27	—0.399	1.130	—0.459	1.344	—0.043	0.726
29	—0.223	1.130	—0.513	1.344	0	0.799
31	—0.405	1.045	—0.308	1.350	—0.176	0.702
35	—0.314	1.045	—0.255	1.265	—0.041	0.696
40	—0.701	1.106	—0.461	1.294	0	0.763
46	—0.625	1.034	—0.407	1.279	—0.179	0.711
65	—0.491	1.139	—0.396	1.423	—0.219	0.880

plus 100 pph. of curing agent "CHLA" show that when the two types of samples are exposed in these media for an extended period of time, both absorption and decomposition occur. Both the pipe samples and cast resin samples immersed in transformer oil, deionized water, and pH_{11} water show a gain in weight; the pipe samples immersed in pH_2 water and moist air show a weight loss; and the cast resin samples in pH_2 water show a weight gain. Exposed fibers may be seen on the surfaces of the pipe samples after nine months exposure.

Conclusions

By examining the three resin systems simultaneously and observing the effects of the various exposure media, it may be said that the three systems used in this test all are affected, although differently. In general, the transformer oil and deionized water have the least effect.

The cast resin samples absorb exposure media; in most cases, the pipe samples decompose. The difference between the two types of samples indicates either glass fiber corrosion or interfacial failure allowing the fibers to abrade from the surface. This would be expected to vary with the resin system used due to surface finish compatibility and altered thermal co-efficients.

As has been mentioned, there is a general loss in weight in the case of the pipe samples. Since these specimens contain more than 50% glass, this would mean that resin absorption would have to be less. Since these specimens actually lose weight, degradation must be occurring at a more rapid rate than does absorption.

Table 4. Percent Weight Change Of Samples Immersed In pH_{11} Water

Exposure Time, Weeks, @ 170° F.	"CL" Cures		"BF_3" Cures		"CHLA" Cures	
	Pipe Samples	Resin Samples	Pipe Samples	Resin Samples	Pipe Samples	Resin Samples
2	—0.510	0.617	0.606	0.641	0.297	0.840
3	1.679	0.829	1.253	0.964	0.428	0.625
4	—0.722	0.757	1.065	1.169	0.852	1.195
5	—0.322	0.871	1.480	1.262	0.423	1.195
6	—0.093	0.938	1.715	1.262	0.511	1.195
8	—0.139	1.100	1.675	1.361	0.423	1.491
10	—0.093	1.030	1.930	—	0.79	—
12	0	1.100	1.770	1.320	0.591	1.125
15	—0.093	1.150	1.810	1.345	0.594	1.075
18	—0.046	1.030	1.860	1.406	0.723	1.170
20	0	1.030	1.110	1.381	0.856	1.395
22	0.092	1.030	1.905	1.320	0.636	1.404
25	—0.139	1.125	1.820	1.320	0.814	0.953
27	0.047	1.051	1.675	1.275	0.806	1.018
29	0.093	1.150	1.910	1.406	0.814	0.992
31	0.093	1.105	1.910	1.406	0.720	0.992
35	—0.041	1.125	1.770	1.406	0.679	0.988
40	—0.325	1.194	1.419	1.473	0.508	1.062
46	—0.041	1.125	1.924	1.347	—	1.150
65	—0.230	1.128	1.635	1.600	0.732	1.159

Table 5. Percent Weight Change Of Samples Immersed In Moist Air

Exposure Time, Weeks, @ 170° F.	"CL" Cures		"BF_3" Cures		"CHLA" Cures	
	Pipe Samples	Resin Samples	Pipe Samples	Resin Samples	Pipe Samples	Resin Samples
2	—1.025	0.318	—1.320	0.105	—1.150	0.114
3	—0.980	0.187	—1.020	0.132	—1.070	0.190
4	—1.165	0.189	—1.450	0.210	—1.062	0.152
5	—1.075	0.215	—1.360	0.289	—1.105	0.190
6	—1.300	0.086	—1.310	0.263	—1.345	0.152
8	—0.745	0.258	—0.920	0.342	—0.864	0.306
10	—0.840	—	—1.170	0.396	—0.941	—
12	—1.025	—	—	0.289	—	—
15	—1.207	0.344	—1.110	0.400	—0.575	0.304
18	—0.885	0.193	—1.600	0.400	—1.425	0.228
20	—0.885	0.344	—1.215	0.400	—0.984	0.304
22	—1.028	0.344	—0.933	0.400	—0.948	0.304
25	—0.843	0.382	—0.926	0.497	—0.948	0.304
27	—1.025	0.365	—1.215	0.445	—1.105	0.342
29	—0.837	0.365	—1.171	0.445	—1.150	0.266
31	—0.701	0.652	—0.885	0.521	—1.105	0.380
35	—0.886	0.598	—1.224	0.447	—1.105	0.342
40	—0.696	0.760	—0.870	0.521	—0.898	0.532
46	—0.708	0.976	—1.114	0.631	—1.024	0.532
65	—0.746	0.964	—1.325	0.631	—1.061	0.532

The data presented in this paper is incomplete, and will be continued at a later date. However, it is felt that the data presented here will help fabricators in their future work, and will provide a usable and accurate measure for determining exposure data.

—THE END

A Control Program for Epoxy-Caused Dermatitis
(*Continued from page 141*)

agement and workers into a false sense of security.

The following are two illustrations of this false security: A pattern-making shop had a high rate of dermatitis, despite scrupulous protective measures stressing the use of gloves and good ventilation. When a state health department industrial hygiene officer was invited to observe the job, he noted that workers habitually removed their gloves before working on certain intricate radii, in order to shape-in the resin by hand. Thereafter, they dutifully restored their gloves, thus locking the amines and epoxies to their skin. On this hygiene officer's recommendation, the workers on thi job dispensed with gloves and used only barrier creams for protection. After each lay-up, they washed thoroughly and reapplied the creams. There was no more dermatitis on this operation.

The management of another plant was proud of their method of supplying barrier creams in sanitary, individual tubes that were carried in each worker's tool box. When a visiting public health officer made a routine check, many of the workers had to go back to ther lockers to find the cream. Installation of a dispenser next to the washroom exit, where workers would apply the cream automatically after each wash-up, lowered the dermatitis rate here.

Yet, on other jobs, with other crews, the individual tube has proved the most effective and most sanitary means of dispensing barrier creams. The moral of these illustrations is merely that it takes interested observation and supervision to discover the forms of controls that will work best in a given job situation.

The above occurences also illustrate another point. There may be times when a plant management that is unaided cannot identify the factor causing a dermatitis outbreak. In such a case, if your company has no industrial hygiene department of its own, you can get help from the industrial hygiene unit of your local or state department of health, medical authorities or from your insurance carrier.

Conclusions

Ideally, the control program should be set up before the company begins to work with epoxies. Such advance planning is reported by one of the plants of the automotive Big-Three which has employed some 80 men on epoxy tooling for more than three years, and has never had to transfer a single worker because of epoxy-derived sensitization.

However, control programs also can take effect even after a mass dermatitis outbreak. In typical cases, a manufacturer of epoxy resins and premixes had a 30% dermatitis rate among the 80 workers in his formulating and compounding departments, but had no cases at all 1½ years later after instituting a control program that emphasized the use of more adequate ventilation, barrier creams, rubber gloves, and aprons. An electrical products manufacturer who had 100% dermatitis some 2½ years ago, has none today in a department nearly five times as large after following a program of worker instruction, isolation, good ventilation, and the use of barrier creams.

It is never too late, and hardly ever very difficult, to establish a control program for the prevention of epoxy-caused dermatitis.

—THE END

GORDON B. THAYER, *Plastics Specialist*
Plastics Technical Service
Dow Chemical Co., Midland, Mich.

Developments in Plastic Materials—1957

THE significant advances in plastic materials during 1957 probably will not be fully recognized for some years. In most industries, it is necessary to look back at least five years to make a satisfactory evaluation of events and to tabulate progress. Many developments in the various plastic materials have been discussed here in the hope that some of them will qualify as significant advances when reviewed five years in the future.

Mergers and consolidations in the plastic material manufacturing industry are notable because of the number of organizations which have reported such changes. Many companies have emphasized their foreign operations, either by beginning to operate outside the United States or by telling more about their foreign enterprises. Large manufacturers have talked strongly if captive molding and extrusion plants to produce components for their products. Competition at the retail level probably is a factor, and freight costs to deliver components from the fabricator to the end-use manufacturer are receiving much worried consideration. These costs are large enough to be obvious to financial experts who may be expected reasonably to have the human tendency to first attack large cost items when trying to effect savings. Discussion of captive fabrication naturally leads to speculation on how to man the captive plants with experienced technical management people. Such people are difficult to find, and the problem of balancing freight savings against possible loss of technological efficiency is largely a gamble.

Formal and informal training and education in plastics engineering continues to grow. Commercial literature published by plastic material manufacturers is available in larger quantity and with increasing amounts of engineering properties data. The list of universities cooperating with the plastics industry on research projects is long. Much of the research work is in the field of practical development rather than basic research. The growth of basic research for the plastics industry by the universities may depend upon successful commercial development of the application research that is being done now for specific projects.

New Materials

A fine accumulation of literature concerning graft and block copolymers appeared during the year. This literature can help the plastics engineer prepare himself for the age of radiation plastics. Radiation can produce free radicals in a polymer chain. In the presence of a monomer which can polymerize by free-radical means, a copolymer can be formed. When a free radical is formed by breaking a side chain of the polymer, the new copolymer is called a graft polymer. The monomer is grafted, in effect, to the original radiated polymer. When irradiation forms a free radical by breaking a main chain of the polymer, the new polymer that forms is call a block polymer. In effect, the monomer enters the existing polymer chain as a block. This is a pointless difference to fabricators at the present time, but it is significant in developing polymers for the future.

Some chemical reactions that have been known for as long as 60 years have resulted recently in the development of a new family of plastics. Linear aromatic polyesters are thermoplastic, and melt in the range of 390-570° F. The flexibility of organic chemical nomenclature makes several acceptable names available for the many resins in the series. The principal resin of interest is made with bisphenol A groups joined by carbonate linkages, and "polycarbonate" is a reasonable name for the compound.

General Electric Company manufactures it, and has registered the tradename, "Lexan." The material can be injection molded, extruded, or cast as a film. Commercial development, however, has been limited to molding thus far. The impact strength of Lexan polycarbonate is 12-16 ft.-lbs. per inch of notch, and

is not sensitive to the speed of testing. Dimensional stability is excellent with negligible age shrinkage. Heat-distortion resistance is 280-290° F. at either 264 or 66-psi. loading in the ASTM test. Chemical resistance is good, but the material is attacked by some solvents and by bases such as ammonia. The polycarbonates possess many useful properties that will stimulate the imagination of fabricator and users of plastics. Availability and price are indefinite quantities at present.

Delrin, the acetal resin announced by Du Pont in 1956, has progressed to the extent of being available in limited quantities as an extrusion and molding compound. It is expected to be fully available as a commercial material in 1959. An extrudable perfluorocarbon. Teflon 100X, has been fabricated in the form of film having heat resistance up to 400° F. Polypropylene is commercially available in Europe from Montecatini as Moplen isotactic polymer. This Italian polypropylene has been introduced into the United States. Hercules Powder Company is manufacturing polypropylene which they call "Pro-Fax." A considerable amount of commercial development will be required before these new materials grow to large volume.

There is a growing tendency for new materials to be tried out in industrial applications for early evaluations. The new materials often have engineering properties in excess of minimum requirements, and the highly competitive fields of housewares, toys, and novelties cannot carry the cost of unneeded properties. Industrial components cannot very well do so either, but the plastics offer cost advantages in light weight and low fabrication costs. Adaptation of the new materials into the housewares field after introduction in the industrial field is exemplified by the history of high- and intermediate-density polyethylene. The adaptation was quick because of the rigidity and more lustrous finish of the higher density polyethylene.

Thermosetting Materials

Considerable development occurred in thermosetting materials that can lead to wider use. Phenolics having up to 70% faster curing rates appeared. Dry-blend phenolic premixes provide the molder with an opportunity to manufacture the lowest cost molding compound suitable for a specific application, and allow him to offer economically a variety of special formulations. The use of automatic molding machinery has continued to expand in the thermosetting field. This has brought about some cost reductions which, in turn, have helped widen the use of phenolics.

High-frequency heating at 60-70 megacycles has been applied in urea-formaldehyde moldings of 3-25 pounds in weight. The high frequency has made it feasible to employ dielectric heating to this type of material, and has increased the potential use of urea-formaldehyde moldings. Melamine-formaldehyde has grown in the fields of dinnerware and adhesives. Two plant expansions of 50% each in the material supply field were announced, and a Melamine dinnerware council was formed to include the manufacturers of 90% of all of the dinnerware produced in the U. S.

Cellulosics

Acetate film and sheeting for recording tapes, pressure-sensitive tapes, and packaging has grown more important. Tough, transparent packages help to sell in the retail store, and protect the goods during their shelf-lives. In the molding powder field, Hercules discontinued the manufacture of cellulose acetate and ethyl cellulose molding compounds.

Polystyrene

The growth curve of polystyrene indicates this material is a mature product that is not subject to large advances and major improvements. However, many small changes have provided desirable combinations of properties for specific applications. Examples are greater translucence in high-impact materials; high-heat materials with higher impact strengths; higher gloss sheet extrusion materials; and sheet extrusion of higher heat-distortion resistance. The volume of polystyrene continues at no decrease and possibly some gain despite losses of applications to other plastics. Packaging and other single-use items account for a considerable volume of polystyrene, and is likely to account for a growing volume in the years to come.

Polyethylene

It is estimated that approximately 400 molding and extrusion formulations of polyethylene are available from more than a dozen manufacturers of this plastic. These 400 formulations cover the spectrum of densities from 0.914-0.962. There appears to be no limit to the variations in addition agents and manufacturing methods that can be used, and it is possible that the number of formulations will grow larger before it grows smaller to a reasonable figure. It is difficult to see how the molder or extruder can keep up with the formulations development that is going on at the present time.

A plastic made of carbon black and polyethylene was announced early in the year by Godfrey L. Cabot, Inc. Fifty percent of the mixture is carbon black and, in some cases, the percentage of carbon black may be higher. The durability of the compound is extremely good, and the strength is remarkably high. High strength appears to have been attained in another system by the use of polyethylene in the molecular-weight range of one million.

Polyvinyl Chloride

Easy processing PVC powder that absorbs plasticizer readily has been introduced by at least three manufacturers. The ease of absorption of plasticizer decreases the blending time and equipment requirements, and cuts costs accordingly. A rigid plastisol of considerable hardness in the range of 100 Shore "A" appeared. Viscosity stabilizers for plastisols were announced and if these stabilizers perform properly, they can change plastisol manufacturing applications.

Polyvinyl chloride has become extremely interesting in the building products field for waterseals, flashing, pipe, light diffusers, and other applications in which the durability and low cost of the plastic make an attractive combination for many applications.

Acrylics

A new methyl methacrylate high-impact, translucent material has been announced by Rohm and Haas. This material has the trade name, Implex, and is reported to have an impact strength of 2.0 ft.-lbs. per inch of notch. It has good weatherability, if not the excellent weatherability of methyl methacrylate resin itself. It has been recommended highly and tested extensively for use in shoe heels.

Epoxy Resins

Fast curing molding compounds appeared in the epoxy resin field. The use of epoxy resins in fixtures and metal forming tools continues to grow. Epoxy coatings have appeared, and although the resins may be costly, it is likely that they will find use where their hardness, scratch resistance, and good color are needed. Epoxy resin combined with polystyrene foaming beads has been announced. The heat of curing of the resin causes the beads to foam. The resin forms a tough skin at the mold surface.

Foams

One of the largest markets for flexible foams is in automobile seat cushions. Rubber, polyurethane, and polyvinyl chloride foams are in this field, and the debate over their relative merits for automobile seat cushions has been conducted widely in various professional society meetings. The magnitude of the market for automobile and furniture seat cushions overshadows other uses for foams, and possibly has obscured the important considerations in the other uses which seem to be minor at the present time.

Urethane garment linings have become commercially accepted, and may grow in volume as sportsmen replace their existing garments. The problem of whether the foam should be made of a polyether or a polyester received a great deal of attention. The properties vary chiefly in the resilience and stiffness of the foam. The polyether is a lower cost material, but it is likely that both types of materials will be required as experience with them grows and shows where each belongs.

Large boards foamed from polystyrene beads have appeared, and are growing into large-scale applications. Moldings made by foaming polystyrene beads also are growing in number of applications.

Film Laminates

Coated and laminated films once were considered too costly for general use. Several years ago, it was considered desirable to make a film for a specific application and not spend more money to combine films with coatings or with other films for special needs. Modern needs for various decorative effects and package protection have changed this old idea. Efficient coating and laminating, plus improvements in printing and converting, have brought costs down. It is possible that the high level of prosperity in the United States has allowed film laminates to grow to large plastic volume. Continuing prosperity and more liberal thinking about what is and what is not high living certainly should be considered in predicting the future of new plastics. The history of laminated films may serve to provide a lesson in this regard.

Reinforced Plastics

Phenolic, polyester, epoxy, silicones, and methacrylate all have received a great deal of attention in technical studies and reports. The reinforcing agents also have been studied extensively during the year. Plastic fibers, asbestos, glass, and sisal fibers are receiving a great deal of attention. A thixotropic thickener for polyester resins was announced. This material will spread readily; but once spread, the resin will not run. This could have a significant effect in both fabrication methods and in the range of products that can be fabricated with polyester resins.

Plastics and Metals

Combinations of plastics and metals appeared in various announcements and short news items during the year. While not one of the announcements seemed to be outstanding, the combination in total is interesting. Epoxy resins combined with ferrite (a form of iron) have been used for absorbers in electronic systems. Lead has been mixed with epoxy resins and with polyethylene to form lightweight radiation shielding which is fabricated readily.

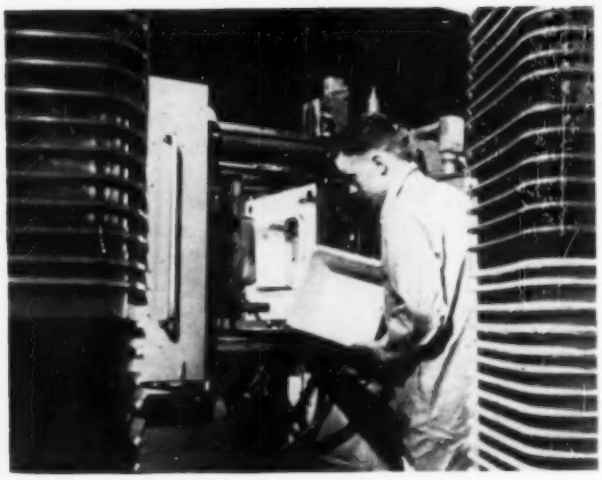
Aluminum has been combined with epoxy and with polyester resins to form relatively hard, thermally-conductive tooling materials. These materials have been used for patching blow holes in aluminum castings, and for a host of every-day uses. Nylon combined with iron has been injection molded as a bearing material.

Each of these mixtures has been made for a sound reason and for specific applications. They were announced without fanfare, and some editors apparently did not feel that they were worthy of very much space. Possibly these and other mixtures of plastics and metals may become a new field of application for plastics materials that will be of considerably more significance than is apparent at the present time.

—THE END

Photo by: Degnan, Selon and Cook

This 27-foot Crystaliner, built of glass fiber-reinforced polyester plastics, was one of eight small craft that bucked 20-foot waves to successfully complete last year's Miami-Nassau race. Photo courtesy of L.O.F. Glass Fibers Co.



Molding Grex polyethylene by the valve gating method.

Valve Gating Injection Molding

A new plastic injection molding technique can save up to 25% of the manufacturing costs for a wide variety of industrial and consumer products. Known as valve gating, the "pre-compression" method was developed and patented by Columbus Plastic Products, Inc., Columbus, O., who has granted an exclusive license to W. R. Grace & Co.'s Polymer Chemicals Division, Clifton, N. J. Grace, in turn, is responsible for arranging licenses that involve royalty payments to Columbus for plastics molders desiring to use the new technique.

Normal injection molding is carried out when the molten material begins to ooze through an opening into the mold cavity. The valve gate technique holds the material in a reservoir, building up pressure that releases the valve and causes the material to gush into the cavity at high velocity. One of the advantages of the new method is that it permits multiple valve gating which permits the molding of larger and deeper pieces having considerably greater areas using smaller machines. In some cases, valve gating makes it possible to mold pieces that otherwise could not be molded, regardless of press size.

The technique has been used by Columbus Plastic Products in production runs with various thermoplastic materials. After work in its own laboratories with its Grex high-density polyethylene, Grace predicts that the new technique will revolutionize not only the molding of similar polyethylenes, but also the molding of all thermoplastics.

Greater economy of operation results from reduced molding cycles, considerably decreased scrap and rejects, and lower finishing costs. Highly improved products are made possible through better physical properties of the moldings and reduced over-all shrinkage. In addition, further economies are provided by reduced weight of the molded parts and a higher degree of automatic molding. Other basic plastics engineering principles in the valve gating technique are the same as for other molding methods. —THE END

Measuring the Abrasion Resistance of Plastic Lenses for Sunglasses
(*Continued from page 136*)

(myriad tiny scratches, single deep gouge marks, pits, etc.) that it seemed unlikely that a haze measurement would rate the different kinds of defects fairly. An over-all, visual rating seemed to be the only reliable appraisal method.

Figure 9 shows the results of the ratings. Each type of lens showed a wide range of loss of clarity, presumably because of the variety of treatments the sunglasses had received in the field. Nevertheless, the difference between the S-13 and S-10 curves is umistakable. The peaks of the two curves occur at about 1.8 and 4.5, respectively; a difference of 2.7 steps or roughly a factor of 3 in linear units.

It is obvious that the field tests, although of limited scope, tend to bear out the conclusions implied by the laboratory tests and increase our confidence in the new abrader. The tremendous advantage of the laboratory tests as regards convenience, time requirements, and precision is self-evident. It is clear, also, that the S-13 coating goes a long way toward giving plastic sunglasses a satisfactory degree of abrasion resistance. —THE END

News of the Societies

SPI Film Division Conference

The eighth conference of SPI's film, sheeting, and coated fabrics division was held December 10-11, 1957, at the Commodore Hotel in New York City. The two-day conclave pointed up the increasing use of quality vinyl film and sheeting products.

Leading the opening session of December 10, Paul Gravenstreter, Clark Controller Co., talked on **"New Types of Calender Drives."** Basing his discussion on techniques of applied voltage regulation to control the roll speeds of several machines operating in series, Mr. Gravenstreter described six systems where the incorporation of voltage regulators and boosters in various parts of the sequence produced some different operating characteristic. The final system discussed represented the ultimate solution in that tracking over a large speed range, and cascade or individual draw adjustment can be accomplished.

Discussing **"Markets for Rigid Vinyl Sheeting,"** Allen J. Baldwin, Nixon Nitration Works, elaborated on the present uses, advantages, and limitations of rigid vinyl sheeting, as well as the advantages and comparative costs of competitive materials. Some of the present applications include luminous ceilings; laminating films; small lampshades; sound recording discs; corrosion resistant coatings; electrotyping molds; food packaging; toys; and printed items.

"Design and Use of Vinyls in Aircraft" was discussed by Danforth Cardozo, Jr., Walter Dorwin Teague Associates, who related some of the problems involved in designing aircraft interiors. Using the interior for the Boeing 707 airplane as an example, he pointed out that some of the requirements included adaptability of color, pattern, and texture; ease of disassembly to reduce maintenance time; weight; and weight-distribution. In the Boeing 707, nearly the entire interior, with the exception of the carpeted area, is lined with vinyl film.

W. W. Patchell, Pennsylvania Railroad Co., talked on **"Designs and Uses of Vinyls in Trains."** Some of the lounge and dining car interiors incorporate vinyl plastics materials in ceilings, walls, stewards counters, and chairs. In the decorating of furniture, these materials combine the luxurious appearance of fine brocades and other fabrics with the practical advantage of materials that are highly resistant to scuffing, stains, soil, mildew, fading, and fire. Use of plastics is expected to increase the life of each car interior redecorating job by more than 300%.

Starting the December 11 session, G. I. Addis, Bakelite Co., described an **"Apparatus for the Study of the Dielectric Heat Sealability of Films."** The sealer proper consists of a rotating electrode similar to those used in commercial applications. Electrode pressure is adjustable, and penetration into the material is fixed by two Teflon idler bushings on each side of the electrode. A variable-speed drive permits speeds from 0-1.5 feet per minute to facilitate tuning adjustments. The understructure of the machine contains a tuning and matching network, as well as a radio-frequency vacuum tube voltmeter probe. All radio frequency power is fed to the machine through a 50-ohm coaxial cable from a separate console. The line feeding the sealer incorporates a bi-directional coupler which senses the incident power and measures the reflected power. Power is supplied from a crystal-controlled, 200-watt power source whose operating frequency can be set by selecting the proper crystal and tuning the power stages. A frequency of 27 megacycles was selected as typical for film-sealing purposes and standardized. An adjustable power supply can control the final output continuously from 0-200 watts, although only a small fraction of this available power is ever used in a seal.

A. A. Kaufman, Prodex Corp., discussed **"Vinyl Film Extrusion."** Comparing the relative costs of the calendering and extrusion process, Mr. Kaufman pointed out that the latter method can be quite competitive with calendering and, in addition, has further advantages defined by the lower space requirements, and lower maintenance, power, and labor costs. For very thin films, the extrusion process is overwhelmingly more economical. Lower production and investment costs of extruded film and sheeting will lead to better and lower-cost products, and in doing so will open up new fields to vinyl film and sheeting.

Freda Diamond, designer and home furnishing consultant, spoke on **"Fashions and Styling Trends."** She recommended that the inherent properties of plastics should be used toward the creation of original designs rather than copying or imitating existing materials.

"Vinyl Laminations" were discussed by Roy W. Ritchie, Rich-Tex, Inc., who described both wet and dry tapes of laminations. He pointed out that end-products are characterized by light weight, strength, flexibility, lend themselves to attractive decorative effects, and have many potential applications.

Announces Advance Program

SPI's Pacific Coast Section has announced the advance program for its 15th annual conference to be held March 26-28, at the El Mirador Hotel, Palm Springs, Calif. A golf tournament at the Tamarisk Country Club followed by the Section's business meeting will comprise the first day's activity. The two remaining days will be devoted to one joint and 12 concurrent technical sessions whose common theme will be "Progress in Plastics." Tentative conference schedules are as follows:

Thursday Morning, March 27

"Progress in Plastic Pipe," a joint session moderated by William Hess, Plastics Pipe and Tube Co. Speakers: Edward Baxter, Portco, Inc., and Ted Stevenson, Sloane Mfg. Co.

Extrusion and Film Section:

"Progress in Thermoplastic Extrusion," E. C. Bernhaardt, E. I. du Pont de Nemours & Co., Inc.

"Automatic Injection Molding at Eastman Kodak," (film) R. K. Halliday, Wilson & Geo. Meyer Co.

"Progress in Skin Packaging with Polyethylene Film," James Morton, Extruders, Inc.

Technical Section:

"Reinforced Plastics Tooling in the Aircraft Industry," speaker to be announced.

"Industrial Design of Reinforced Plastics," William McKay, Zenith Plastics Co.

"The Application of Reinforced Plastics in Commercial Jet Aircraft Design," panel. Moderator, Paul Layton, Owens-Corning Fiberglas Corp.; speakers, Richard Morozowicz, Douglas Aircraft Co., Inc., and Hal Rosenbaum, Convair Div., General Dynamics Corp.

Friday Morning, March 28

Extrusion and Film Section:

"High Density Polyethylene," panel. Moderator, Lloyd Johnson, Jet Specialties; speakers, Richard Askew, Philips Petroleum Co., and W. O. Bracken, Hercules Powder Co.

"Mold Design and Techniques for Injection Molding," Jack Totten, A. B. I.

"Irridation Treatment of Non-Reinforced Plastics," W. T. Googgin, Dow Chemical Co.

Technical Section:

"The Future of Reinforced Plastics in Transportation," speaker to be announced,

"The Recent Developments in the Use of Premix Material," Norman Lapworth, General Plastics Co.

"The Use of Reinforced Plastics in Building Construction," panel. Moderators, Frank Ambrose, Alsynite Co., and Luigi A. Contini, Monsanto Chemical Co. Speakers to be announced.

Group Elects Officers

Following its 44th annual meeting, held December 9-12 at Hollywood, Fla., Chemical Specialties Manufacturers Association, New York, N. Y., has announced its election of officers as follows: president, James E. Ferris, Hooker Electrochemicals Co., Niagara Falls, N. Y.; first vice president, Donald M. King, Masury-Young Co., Boston, Mass.; second vice president,

George W. Fiero, Esso Standard Oil Co., New York, N. Y.; secretary, H. W. Hamilton; and treasurer, Peter C. Reilly, Reilly Tar & Chemical Corp., Indianapolis, Ind.

Named to three-year terms on the association's board of governors were: Charles E. Beach, John C. Stalfort & Sons, Inc., Baltimore, Md.; Charles E. Allerdice, Jr., The Bell Co., Chicago, Ill.; and Harry E. Peterson, Peterson Filling & Packaging Co., Danville, Ill.

SPE's 14th Annual Conference

The fourteenth annual National Technical Conference of the Society of Plastics Engineers, Inc., was held on January 28-31 in the Hotel Sheraton-Cadillac, Detroit, Mich. Registration totaled over 2,780, and company registrations hit a new high. Sponsored by SPE's Detroit Section, the Conference had as its theme "Progress Through Plastics Engineering."

The technical program consisted of concurrent sessions on each of the four mornings, plus the first three afternoons. An educational symposium was held on the evening of January 28; Conference luncheons were held on January 28 and 29, speaker at the latter being Charles A. Chayne, vice president of engineering for General Motors Corp.; and the annual President's Cocktail Party and Banquet was held on January 30. In addition, the Professional Activities Group held a number of luncheons for interested attendees.

A total of 99 technical papers were presented at the Conference. The morning session on January 28 dealt with the subject of radiation and plastics, as did one of the afternoon sessions. Other afternoon sessions covered epoxy resins and embedment, extrusion, and injection molding. Morning sessions on January 29 were devoted to packaging, plastic tooling, mold design, and new materials. That afternoon, speakers were concerned with test methods, injection molding, reinforced plastics, and extrusion. January 30 saw new materials, automotive applications, color and finishing, and mold design explained in the morning; potpourri, extrusion, injection molding and foams in the afternoon. Friday morning featured sessions on compression molding, sheet forming, new materials, and rheology.

National officers of the Society during 1958, elected by the National directors are as follows: president, R. Kenneth Gossett, Gossett & Hill, Inc.; vice president, Fred Sutro, Spencer Chemical Co.; secretary, George W. Martin, Holyoke Plastics Co., and treasurer, G. Palmer Humphrey, R. C. Molding, Inc.

The after-dinner speaker at the banquet was Dr. Henry Pildner, of the Atomic Energy Commission's industrial division, whose topic was "Business and Industry in the Atomic Age." Other highlights included the Dow Male Chorus offering a number of selections, and a talk by the new president, Mr. Gossett. The arrangements for the Conference were handled by a 22-man committee with Carl H. Whitlock, Whitlock Associates, Inc., as general chairman. Co-chairmen were John G. Slater, Eastman Chemical Products, and Jay H. Kuhn, Wolverine Plastics Corp. Secretary was Iver J. Freeman, Reed Prentice Corp., and the treasurer was Fred E. Schwab, Schwab Plastics Corp.

SPE National Officers for 1958: (left to right) George W. Martin, secretary; Fred Sutro, vice president; R. Kenneth Gossett, president; and G. Palmer Humphrey, treasurer.

SPI Metropolitan Chapter

The Metropolitan Chapter of the Society of the Plastics Industry, Inc., held its second meeting on December 12, 1957, at the Yale Club in New York City. Approximately 80 members were in attendance. Martin Summerfield, professor of jet propulsion at Princeton University's Department of Aeronautical Engineering spoke on "Satellites and Ballistic Missiles," and an Eastman Chemical film entitled "A Portrait of Plastics" was shown.

According to Dr. Summerfield, rocketry research began in 1903, and here the Russians can claim a true first—the study was made by Constantine Ziokovsky. In 1919, Robert Goddard worked out a theoretical method for sending a 10-stage rocket to the moon. We find that the new developments involve fuel and insulating materials, not new concepts.

The first rockets used aniline as a fuel and nitric acid as the igniter. In the search for better fuels, experimentation turned up nitromethane which could be triggered by a small blasting cap. Its explosiveness was a problem, however, and it posed a great cooling problem. Liquid oxygen plus alcohol, as used in jet planes, offered high speed but very short range.

In the field of solid propellants, plastics have been suggested. TNT should work, but the storage problem rules it out. In 1940, experiments were conducted with potassium perchlorate and molten asphalt; later ammonium perchlorate was substituted for the potassium perchlorate. Later polystyrene and polysulfides were used since asphalt would not retain its shape under heat, and shape determines thrust and duration. Other materials tested include hydrozine and diborane. Dr. Summerfield felt that the ideal combination for the highest impulse would be liquid hydrogen and fluorine, but that storage problems would be insurmountable.

low cost, break resistant

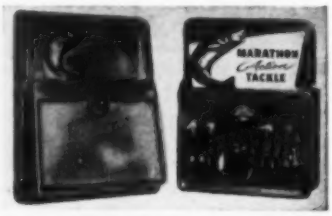
ELECTROFORMED MOLDS

like these . . . spell

F-A-S-T C-Y-C-L-E-S and A-C-C-U-R-A-C-Y

in plastisol molding and vacuum forming
and low pressure injection molding

Top photo courtesy Dimensional Products Co., Milwaukee, Wis.



FOR PLASTISOLS

- High, even heat transfer
- Rapid cure with uniform thickness
- Hard copper alloy resists breakage

FOR VACUUM FORMING

- Rapid and high production from water-cooled electroformed copper molds
- Multiple molds from a single master

FOR INJECTION MOLDING

- New—Hard nickel-plated molds for amazing reproduction of detail

We work from your wax, metal or plastic patterns.
Send print for quotation. Sample mold (medium size)
from your pattern, $25. Write today.

PLATING ENGINEERING CO.

1928 South 62nd St. • Milwaukee 14, Wisconsin • Phone: EVergreen 4-4848

News of the Industry

Plastics Industry Report, 1957

Last year the plastics industry, exceeding itself for the sixth consecutive time, enjoyed a 7% increase over 1956 with production totals for plastics, and resin materials reaching 4,387,000,000 pounds, according to a report issued by the Society of the Plastics Industry, Inc., New York, N. Y. Exceeding $2-billion for the second consecutive year, total dollar value of plastics products in 1957 stood at approximately $2,100,000,000 as compared with the 1956 aggregate of $2,050,000,000.

An estimate of last year's production totals, together with their fluctuations relative to 1956, are tabulated for some of the principal materials as follows:

	Million lbs.	Fluctuation, %
Vinyls	841.2	+11.8
Polyethylene	682.8	+22.6
Polystyrene	635.4	+ 1.1
Phenolics and other tar acid resins	475.9	— 7.1
Urea and melamines	308.5	— 2.8
Cellulosics	151.0	+ 3.5
Polyesters	98.4	+30.7

While total dollar sales for molders and extruders fell behind the production increase achieved by this segment of the industry, it is felt that this was due to lower prices resulting from keen competition. SPI mold sales statistics, generally regarded as an indication of the future trend of new business, continued to run somewhat higher than the year before with an increase of 2½%. This, however, contrasts with a 16% increase during 1957.

Probing general business conditions, SPI conducted a survey among its 950 member companies in the United States. Of the 32% who returned the questionnaires, a majority indicated either a static condition or an up-trend in sales and profits, while a smaller group claimed an off-year for 1957. Planned expansions ranging from 5-600% were claimed by about half of the companies, with the greatest increases being undertaken by smaller organizations.

According to a product break-down, those indicating substantial plant expansions included sheet formers; producers of epoxy resins, reinforced and cellular plastics; and manufacturers of housewares, pipe, toys and specialized machines.

Thermoplastic pipe, manufactured on a proprietary as well as a custom basis, reached a total of approximately 58,000,000 pounds, as compared with 55,000,000 pounds in 1956. Fabricated from polyethylene, cellulose acetate butyrate, PVC, and styrene base formulations, thermoplastic pipe production is expected to reach 60,000,000 pounds during the current year.

Cellular or foamed plastics, produced from basic resins such as vinyl, urethane, and polystyrene, exceeded 30,000,000 pounds in 1957, which was nearly a 100% increase over the 16,000,000 pounds produced in 1956. These plastics, while relatively new to the field, have drawn considerable interest because of their many applications as cushioning and seating materials, rug under-lays, and thermal and acoustic insulators. A production of cellular plastics in the neighborhood of 40,000,000 pounds is expected this year.

Two outstanding developments in 1957 included the commercial availability of high density polyethylene, and a second olefin, polypropylene, which made its appearance on the European market late in the year. In December 1957, one American firm, Hercules Powder Co., went on-stream with a plant for its production.

While the profit squeeze is expected to intensify during the early months of the year, the situation may be alleviated somewhat by a $2,000,000,000 rise in defense spending along with anticipated easier money rates. Based on the survey and the industry's expansion plans, SPI estimates a one or two percent increase in over-all plastics output during 1958.

Chemical Industry Report

Chemical industry investments in domestic construction will approximate $2,540,000,000 during 1958 and 1959, according to a survey taken by the Manufacturing Chemists' Association, Inc., Washington, D. C. The estimate was based on existing and proposed activities of chemical companies, and the chemical operations of firms whose primary specialties lie in other fields. Included in the figure are 322 projects already underway, and 119 that are scheduled for ground-breaking and completion before 1960.

Early in 1957, the industry moved into the number-three position, relative to the national economy, and today claims total assets of $19,600,000,000. During that year, the survey revealed, chemical producers completed 309 domestic construction projects at a cost of $1,300,000,000.

Total expenditure for construction during the three year period ending in 1959 is expected to reach $3,840,000,000. A record investment, this involves 750 projects that have been completed, undertaken, or planned by 344 companies. The estimate is exclusive of government-financed construction, and monies spent on service facilities such as office and warehouse space.

Greatest investments are in production facilities for general organic chemicals, which leads the list with $987,019,000. General inorganics, in second place with $710,521,000, were followed by metals, $614,825,000; plastics and resins, $451,440,000; synthetic rubber, $297,780,000; petrochemicals, $242,415,000; fertilizer chemicals, $210,875,000; synthetic textile fibers, $161,000,000; laboratories, $107,215,000; miscellaneous, $62,350,000.

The investment in research laboratories is considered particularly significant, and the figure quoted includes $31,220,000 for completed construction; $67,870,000 for current construction; while investments in projects still in the planning stage stand at $8,125,000. The industry's total research expenditure, including operating costs, currently is estimated at $500,000,000 a year.

The most extensive projects are centered in Texas, where total investments reached $864,500,000. Louisiana was second, with $494,000,000, followed by West Virginia with $272,000,000; Ohio, $228,000,000; California, $188,700,000; New Jersey, $155,000,000; Florida, $144,700,000; Tennessee, $127,600,000; Pennsylvania, $120,000,000, and Illinois, $119,500,000.

Expands Cellophane Output

Anticipating an active cellophane market during 1958, an expansion program has been launched by the film division, American Viscose Corp., Philadelphia, Pa. The plan calls for additional production facilities at Marcus Hook, N. J. which, when completed, will increase the firm's annual output capacity to 150-million pounds. Other phases of the program will include the establishment of a distribution center in Chicago, Ill.; introduction of technical information centers; and a general strengthening of technical and sales services.

The program is designed to exploit a broadened market created by low inventories among users; expansion of present applications; and the development of new products which will increase cellophane's market possibilities.

In a 1957 market review, Avisco found that widespread packaging changes affected even established users. The tobacco industry for example, long considered a stable user, required a greater quantity of cellophane to wrap five-pack cigar packages, and containers for king-size and

filter cigarettes. It was found that tobacco and food packaging accounted for most of the recent increases in the cellophane market, although considerable support was lent by textiles and hard goods.

Other contributing factors included the more widespread use of fractional packaging, which is defined as the interior packaging of two or more small units within a consumer package; bundling, which is the fastening together of two or more small units within a consumer package; and multi-unit packaging in which two or more unit-of-sale packages are combined for consumer purchase.

Labeling Contest Awards

Grand prize for the best informative label, submitted during SPI's third annual informative labeling contest, was awarded to Federal Tool Corp., Chicago, Ill. The award was presented in recognition of the company's two product labels for the Rainmaster Sprinkling Can, and the Silent Minnow Pail. Presentation was made at a luncheon, held January 20 at the Hotel Sherman, Chicago, Ill.

Awards in four other product categories were made as follows: building materials, Alpha Plastics, Inc., Livingston, N. J., for its Alpha PVC Solvent Cement Can label; home furnishings, American Cyanamid Co. New York, N. Y., for its Melmac Dinnerware tie-tag; housewares, Plas-Tex Corp., Los Angeles, Calif., for the Plas-Tex Waste Basket label, and their Ice Bucket tie-tag; and toys, North Star Industries Inc., Hopkins, Minn., for its Bunny Rattle label. The winners were selected from 106 entries submitted by 45 companies.

Plumbers Study Plastic Pipe

A training program, designed to help plumbers and pipefitters in adapting their skills to the installation of plastic pipe, has been inaugurated by General Tire & Rubber Co.'s Bolta Products Div., Lawrence, Mass. The courses are sponsored by the Lawrence Independent Industrial School, and are approved by the Massachusetts Department of Vocational Training.

Classes are held two evenings a week and consist of a lecture hour during which trainees are taught the physical properties of thermoplastic pipe, applications for which it is best suited, and correct installation techniques. Following the classroom period, two hours are devoted to manual shop-work practice. Classes are limited to 12 trainees, and are open to any qualified craftsman having a minimum of four years experience.

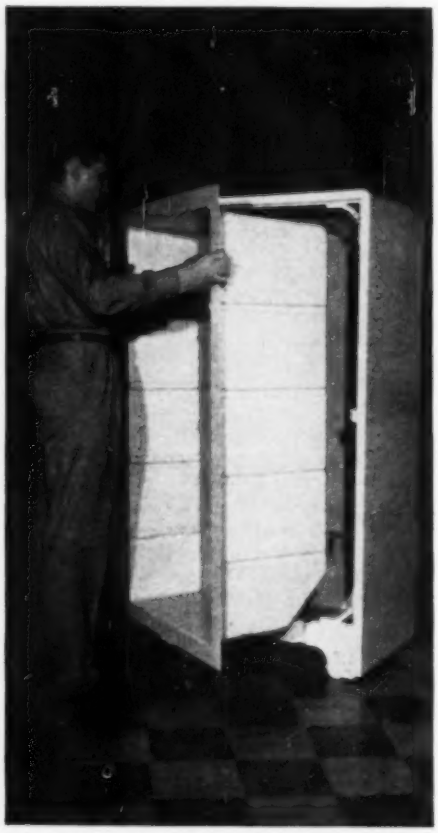
Paper Firm Processes Plastics

Traditionally a manufacturer of sanitary paper products, Scott Paper Co., Chester, Pa., has departed from its 80-year path to enter the foamed plastics field. Introducing a urethane material called "Scottfoam", the company claims for its product a tensile strength, elongation, and drape, that is superior to that of conventional types.

Available in both flexible and rigid varieties, the material can be used as a thermal or acoustic insulator; a filter for liquids and gases; and for cushioning as well as other household and industrial applications. "Scottfoam" will make its first commercial appearance as a garment interlining, in the products available from Brand and Oppenheimer, Inc., New York, N. Y.

Develops One-Piece Liner

An all-plastic refrigeration liner, molded in one piece from high impact polystyrene, has been developed by Capac Industries, Inc., Capac, Mich. The liner can be engineered to any type refrigerator, and can incorporate the beaker frame, shelf guard, and light wells as integral parts. In addition to eliminating condensation, the high insulating value of the polystyrene permits reduction in insulation thickness. The Capac process, which economizes on assembly time and tool costs, is said to result in a lower priced product.



Capac liner being installed inside cabinet flange.

Handicapped Children Benefit

A design competition, intended to promote and upgrade the use and application of plastics in the toy field, is being sponsored by Koppers Co., Inc. The contest is open to all molders, extruders, fabricators, and proprietary manufacturers of polystyrene and polyethylene toys. Product entries must be made from regular or rigid polyethylene, or a recognized type of polystyrene.

Awards will consist of five first prizes of $1,000, which will be presented to an accredited summer camp for handicapped children in the name of the winning fabricator. In addition there will be three honorable-mention awards made in each of the five categories specified.

The panel of judges will include Dr. Frances Horwich, who doubles as Miss Frances on T.V.'s "Ding Dong School" program; Dr. Jesse H. Day, editor, S.P.E. Journal; and William M. Goldsmith, Design Research, Inc., Chicago, Ill. All toys will be judged on the basis of design, proper application, imaginative use of material, and sound construction.

Categories in which entries may be submitted are hobbycraft products; play-toys retailing at more than $5.00; play-toys retailing between $1.00 and $5.00; play-toys with a retail value less than $1.00; and infant items for children too young to walk.

Products will be judged April 16-18 in Chicago, Ill., and awards will be announced at a dinner scheduled for May 21 in New York City. Entries must be submitted before midnight, April 10, and should be shipped, mailed, or delivered to Administration Committee, Koppers Design Competition, 950 Koppers Bldg., Pittsburgh 19, Pa.

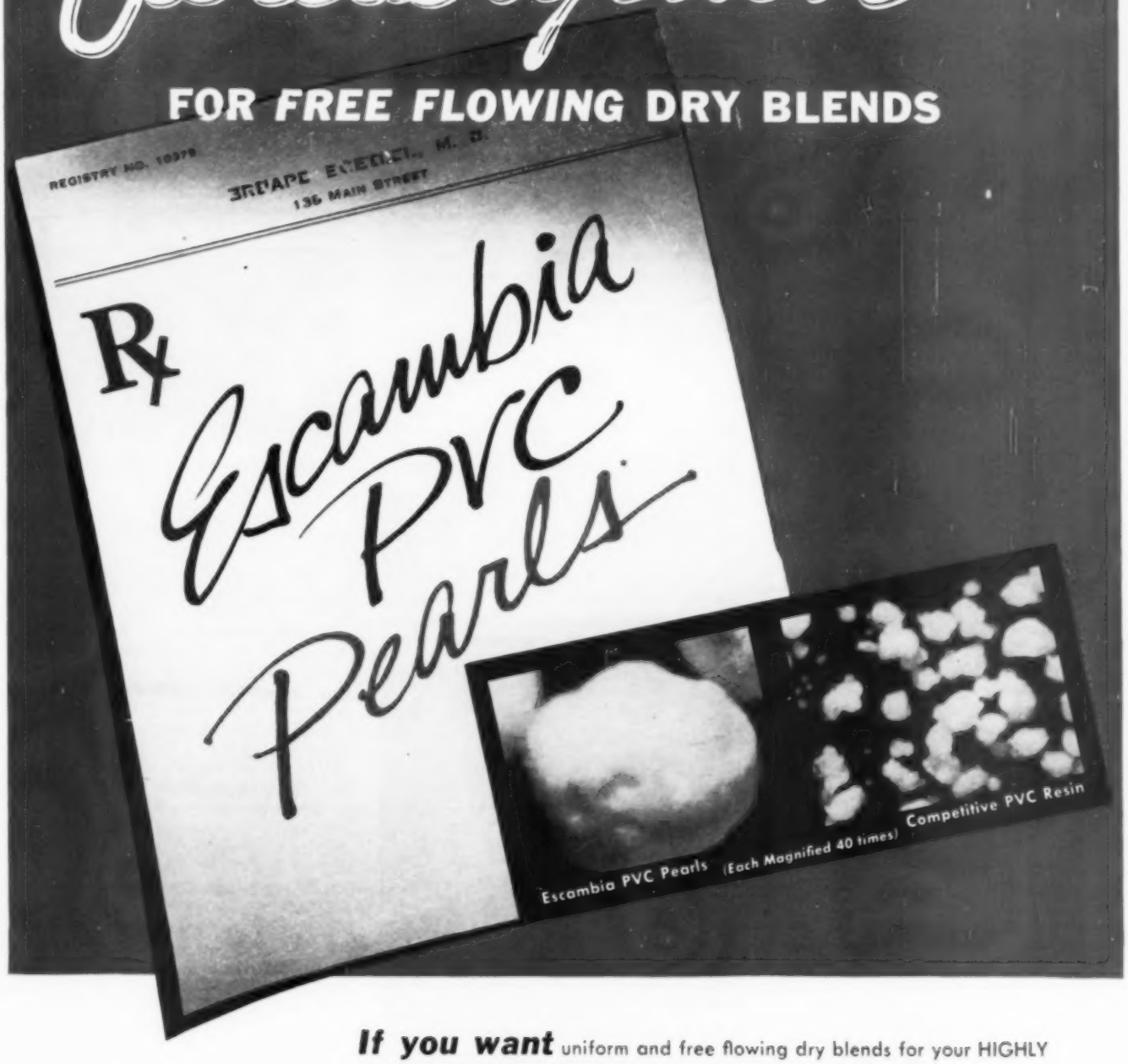
Pools Polymer Programs

Collaboration on plastics polymer research, using newly-developed catalysts, has been announced jointly by National Lead Co. and Celanese Corp. of America, both of New York, N. Y. The catalysts, products of National Lead's research laboratories, are certain organo-titanium compounds which reportedly constitute an important step toward the successful production of unique polymers, including new types of polypropylene and polystyrene.

According to the joint statement issued by the two companies: "Much stronger, more highly heat-resistant plastics can be developed by controlling the molecular structure of polymers . . . Currently almost all polymer production is conducted under conditions which result in linking the molecules into random patterns. Through employment of the new advanced catalysts, these polymerizations are expected to make possible more economical plastics and fibers with outstanding physical properties."

Prescription

FOR *FREE FLOWING* DRY BLENDS


REGISTRY NO. 10378
136 MAIN STREET
Rx
Escambia PVC Pearls
Escambia PVC Pearls (Each Magnified 40 times) Competitive PVC Resin

If you want uniform and free flowing dry blends for your HIGHLY PLASTICIZED FORMULATIONS, you want Escambia PVC Pearls — the resin with unusually high plasticizer absorption capacity.

More plus factors for your product —
Complete freedom from fines . . . Outstanding heat stability . . . Freedom from "fish eyes" . . . Excellent color and clarity.

*PVC Pearls is a trade mark of Escambia Chemical Corporation

For samples and additional information on this completely new PVC . . . Write or call —

ESCAMBIA CHEMICAL
CORPORATION

261 MADISON AVENUE • NEW YORK 16, N. Y.

Northwest Plastics' recently completed plant at Gastonia, N. C.

Holds Dedication Ceremony

An opening ceremony, dedicating its subsidiary molding plant in Gastonia, N. C., was held December 10-11 by Northwest Plastics, Inc., St. Paul, Minn. At their southern facility, the company uses nine compression presses and one injection press to produce electrolytic condenser enclosures for the electronics industry.

Forms Development Group

A research and development group, known as Larkin Associates, Inc., has opened offices at Huntington Station, N. Y. The organization specializes in such areas as reinforced plastics, metal-to-metal and honeycomb bonding, chemical milling, sealants, and encapsulation of electronic components.

Boat Builder Burgeons

Capacity production of reinforced plastic boat hulls has commenced at Molded Fiber Glass Boat Co.'s recently-erected plant at Union City, Pa. The 6,000 square-foot facility, which was built to house operations formerly handled at Ashtabula, O., is geared to the production of 12½- and 15-foot hulls. An expansion of the present two-shift capacity of 60 hulls per day is under consideration, in order to accommodate anticipated 1959 demands.

Molded Fiber Glass Boat Co.'s new hull fabrication facility.

Constructs Acrylic Plant

The U. S. A.'s first facility for making glacial acrylic acid in large commercial quantities is under construction at Calvert City, Ky., according to an announcement by B. F. Goodrich Chemical Co., Cleveland, O. Expected to be on-stream in early 1958, the plant will have an annual capacity of several million pounds. The company claims that availability of the glacial product on this scale should offer important handling advantages to manufacturers now using water solutions of acrylic acid.

The plant also will be geared for the production of acrylic resins, and related chemicals, including Good-rite TS-20, a processing size for nylon; Good-rite CB-35, a foundry corebinder; and additives for pharmaceutical, cosmetic, and latex paint formulations. In addition to the acrylic facility, Goodrich's development in Calvert City includes a vinyl chloride monomer operation, and an acrylonitrile plant.

Develops Shipping Container

A one-ton shipping container, which reduces the expense and trouble involved in handling bulk shipments of powdered or granular materials, is being made available to the chemical industry by E. I. du Pont de Nemours & Co., Wilmington, Del. Called "Pillar-Pac", the unit was originally developed to handle adipic acid

Du Pont's one-ton "Pillar-Pac".

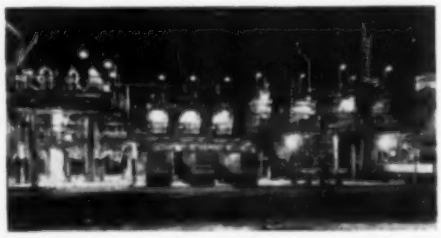
shipments, and will be marketed by licensed manufacturers.

Of rugged, corrugated construction, the container consists of a fiberboard tube or sleeve, encased in a flanged rectangular body. Interior surfaces are coated with a water repellent finish; the top and bottom are fitted with easily removable covers; and the entire unit rests on a built-in pallet to expedite fork-lift handling.

The "Pillar-Pac" can be stacked two high, and 39 containers can be shipped in a standard box car. The unit has good scrap value; can be re-used as a bulk package for end products; makes a convenient waste receptacle; or can be cut up to make smaller shipping containers. Its dimensions in inches are: length and width, 33⅛; and height, 57.

Opens Gulf Coast Plant

An $18,000,000 high density polyethylene plant has been placed on stream at Baton Rouge, La., by the polymer chemicals division of W. R. Grace & Co., New York, N. Y. The plant employs 225 people, has an annual capacity of 50,000,000 pounds, and includes research and development facilities as well as those necessary for commercial production.



W. R. Grace's Baton Rouge plant.

Develops Laminate Process

A vinyl-metal laminate bonding process that eliminates high temperature deterioration of the adhesive and resultant delamination of the materials used, has been developed by Arvin Industries, Inc., Columbus, Ind. Under previous methods, when the laminate is subjected to heat, the adhesive breaks down and the vinyl peels back from the metal, creating a skirt-like or "ballerina" effect along the edge.

Drawn parts laminated with the new method have been subjected to a temperature of 190° F. for four hours without delaminating or showing a measurable weakness of the bond. The new process is especially valuable in the manufacture of radio and television cabinets, and other items that may be exhibited in display windows and subjected to severe radiant heat.

Opens Testing Facility

A plastics consulting service, specializing in research, development, and materials testing and evaluation, has been formed by Plas-Tech Equipment Corp., Waltham, Mass. Controlled conditions, conforming with A.S.T.M. specifications on plastics, are achieved in an air conditioned laboratory. In addition to the testing services, the company markets a machine for measuring tensile, flexural, and stress-relaxation properties at exceptionally high rates of loading. The corporation is under the management of Melvin Silberberg and Ross H. Supnik.

Names in the News

Lawrence M. Baxt

Lawrence M. Baxt has joined colloidal dispersions department of Columbian Carbon Co., as cheif chemist. He will be located at the company's Tacony plant in Philadelphia, where he will direct technical service, quality control, and development.

William H. Willert has been elected a vice president with Frank W. Egan & Co., a plastics machinery firm with headquarters in Somerville, N. J. He formerly served with Firestone's plastics division and with two extruder manufacturers.

Gene Licklider has been appointed production manager of Campro Co., Canton, Ohio molders. He formerly served as production manager with Skotch-Hamilton Corp. **Glen Barnett** has joined Campro as chief engineer. He is a former design consultant, and also served with Diebold, Inc. **Ira A. Abernathy** has been named superintendent of assembly and finishing operation. **Robert Arner** has been promoted to head of purchasing and traffic, and **Joseph Yakubik** becomes superintendent of molding operations.

Paul Rich has joined the Leominster Mass., sales office of Eastmen Chemical Products, Inc. He will sell Tenite in the New England area.

L. Edward Klein and **David T. Mowry** have been appointed assistant directors in the development department of Monsanto Chemical Co.'s organic chemicals division. They both move up from section managerships within the department.

Metal & Thermit Corp., has announced the following transfers among members of its middle management group:

D. W. Oakley, former technical advisor to the president, becomes production manager. **H. A. Rack** moves from production manager to manager of engineering. Assistant manager of market development **C. H. Carpenter, Jr.,** has been appointed technical advisor to the president. **K. E. Doud** has been named assistant manager of engineering, and **R. E. Davis** has been transferred from the firm's central engineering department to its market development division.

Edwin A. Norris has been appointed general manager of General Tire & Rubber Co.'s Marion division. Prior to joining General three years ago, he served as general manager of Standard Products Co.'s Port Clinton division.

Herbert R. Erickson has joined Borden Co.'s chemical division as development manager of its Resinite department. He came to the firm from Boeing, where he developed and coordinated specifications in the fields of plastics, adhesives, and sealants.

Joe M. Gafford

Joe M. Gafford has been appointed head of W. R. Grace & Co.'s manufacturing department at the new polyethylene plant, Baton Rouge, La. Formerly superintendent of Escambia's Pensacola facility, he will be responsible for all production activities related to polyolefin resins.

C. R. Brown, former assistant works manager for Diamond Alkali's Painesville plant, has been named director of labor relations for the firm. **Albert J. Ingley** becomes manager of employe benefits and salary administration, and **Glenn H. Varney** becomes personnel manager. **Robert E. Frey** has been appointed assistant works manager.

P. J. McGale

P. J. McGale has been appointed general manager, special accounts, for B. F. Goodrich Canada, Ltd. Former district manager and manager of government and project sales, he succeeds the late G. R. Donaldson.

Harold H. Radke has become a development program analyst for B. F. Goodrich Chemical Co. He will work in conjunction with **Dr. B. M. Zwicker,** director of new products planning.

Robert L. Rice has been appointed general sales manager of Fischer & Porter Co., manufacturer of process instrumentation. He joined the firm in 1950 as a sales engineer, later becoming Cincinnati area sales manager and manager of the water & waste division.

Ned W. Spangler has been appointed manufacturing superintendent of Sylvania Electric Products' plastics plant in Warren, Pa. He previously served as division industrial engineer.

Morris A. Kimmel has been appointed New England sales representative for Colton Chemical Co., a division of Air Reduction Co. His base of operations and warehousing will be in Boston, Mass.

John M. Jewell has assumed the newly-created position of field sales manager for Houghton Laboratories, Inc. He will also have charge of general product promotion, advertising, and publicity. **Jean Cauchois, Jr.,** has been named manager of the adhesives and coatings division.

Dave Donnan has been appointed product sales manager of automotive original equipment at General Tire & Rubber Co.'s Bolta Products division. He succeeds **Bomar Kramer,** who has been transferred to General's Akron offices. Former sales manager for saran monofilament yarns, Mr. Donnan will direct the marketing of Boltaflex vinyl upholstery materials. He is, in turn, replaced by **James J. Pollack.**

Names in the News (Cont'd.)

Kenneth A. Mack

Kenneth A. Mack has been elected vice president in charge of Baker Perkins' chemical machinery division. An employe since 1937, Mr. Mack is well known in the field. He will retain his present responsibility of sales manager.

William F. Lavelle has been appointed assistant advertising manager of the Naugatuck Chemical division, U. S. Rubber Co. He has been a member of the chemical division's advertising staff since 1953.

R. S. Abrams has been appointed general manager and **L. J. Sinnott** has been appointed general sales manager of Union Carbide Corp.'s silicones division. Both men joined the organization in the early '40's as development engineers.

A. G. Anderson has been named southern district manager of Pfaudler Co. A company employe since 1936, he worked in the New York, Chicago, and Dallas offices before coming to Houston in 1953.

C. J. O'Sullivan has been assigned to the New York district office of the chemical sales division, Shell Chemical Corp. He will be concerned primarily with the sale of Epon resins in New York City and Long Island.

W. Harrison Faulkner, Jr., has been appointed general manager, engineering and development, for Tracerlab, Inc. Former chief engineer of the industrial division, he has served also as business manager of the western division.

Eugene L. Martinez has been appointed manager of Dow Chemical's Boston office, succeeding **A. A. Lawrence.** He is replaced as Buffalo sales manager by **E. H. Killheffer, Jr.**

Leo P. Birzten has been elected vice president in charge of plant operations for Bro-Dart Industries, Newark, N. J. **Bernard Ruback** becomes vice president in charge of finances. Mr. Birzten formerly headed up the field technical and customer service departments for Celanese plants.

Thomas D. McGuire has been added to the Chem-o-sol sales division of Chemical Products Corp. He will cover the upper New York and adjacent territories. Mr. McGuire has over 10 years experience in the technical sales of vinyl dispersions.

William Nelson

William Nelson, assistant secretary of H. Kohnstamm & Co., Inc., has been named sales manager of its western division. A 35-year veteran with the company, he continues as a firm officer in addition to his new duties.

IMPCO HA8-275

750 Dry Cycles Per Hour at Full 14¼" Stroke with this 8-10 ounce machine

Send today for Bulletin P-114.

IMPCO

IMPROVED MACHINERY INC.
Nashua, New Hampshire

In Canada,
Sherbrooke Machineries Limited,
Sherbrooke, Quebec

Export Distributors: OMNI PRODUCTS CORP.
460 Fourth Avenue, New York, New York

News from Abroad

Russian Plastics Education

During October 15 to November 6, 1957, a five-man delegation consisting of the principal and three department heads of the College of Technology, Birmingham, England, and an interpreter, visited Russia at the invitation of the Russian Ministry of Higher Education, to view Russian methods of education. In a recent issue of "British Plastics" (December 1957), G. Tolley, head of the Department of Chemistry at the Birmingham College of Technology, detailed some aspects of plastics education in Russia from which the following information and impressions are gathered.

There is a marked tendency to encourage students to spend one or two years in industry after they have finished school and before they go to the Universities. Some 60% of all students entering the universities and colleges in any year must have had industrial experience, and apparently only the best students go directly from the schools to the higher institutes.

Universities are responsible for pure science and the humanities. Technological work is done in polytechnics or specialized institutes, many being very large and having impressive traditions of achievement. In addition, there is a number of specialized craft-level institutions.

Three centers of plastics education were visited: Mendeleev Institute of Chemical Technology, Moscow; Institute of Chemical Engineering, Moscow; and the Institute of Chemical Technology, Dnepropetrovsk.

While certain lacks were noted on the technological side at Mendeleev, research work in the technical laboratories was found to be of a very high quality, and Mr. Tolley would classify a graduate of this institute as a plastics chemist with very good knowledge of the chemistry of plastics and a working knowledge of processes. At Dnepropetrovsky, the emphasis at present is mainly on chemistry, but there are plans for considerable expansion involving several new laboratories, also for technological work. At the Institute of Chemical Engineering, Moscow, the emphasis is mainly on design. Mr. Tolley considers the laboratory not so well equipped as his own, but diploma and post-graduate work in the technological laboratories is of very high standard. The author was particularly impressed by the enthusiasm of staff and students, and the high quality of plastics engineers produced.

The three institutes together produce 175 qualified plastics technologists annually, of whom 50 are engineers. A number of these stay on at the institute to continue post-graduate work, while others join the Research Institute of the Ministry of Chemical Industry or other ministries. From 40-60% of the students in plastics, rubbers, and paints are women.

The delegation also visited the Karpov Institute of Physical Chemistry for Industry, in Moscow, which has a staff of 700, including almost 200 qualified scientific workers engaged in work on high polymers. This includes electro-chemistry, the kinetics of inorganic reactions, the initiation of polymerization by ionizing radiations, electron diffraction, studies of isotactic materials; mechanical properties of polymers, and Ziegler catalysts.

An important conclusion drawn from the visit was the vitally important position held by the technological Institutes in Russia. "Industry looks to these institutes constantly for advice and cooperation," Mr. Tolley says. "There is extremely close contact between staffs in industry and the academic staff, and each institution has a number of plants allotted to it for the purpose of arranging the industrial training of students. There is no fear of a shortage of the academic staff in Russia because salaries are graded to insure that this will not happen." As a consequence, men of considerable industrial experience find their way into technological institutions as professors and as senior lecturers. Finally, the very efficient information and abstracting services available in Russia are mentioned.

Japanese Plastics in 1957

During the first half of 1957, Japan imported a total of 17,226 metric tons of plastics materials including the following (all quantities are in metric tons):

Phenolics	188
Polyester resins and plastics	135
PVC	430
Methylmethacrylate resin	253
Polyethylene	9,922
Polystyrene	4,993

During the same period, exports of plastics materials came to 4,215 metric tons, including:

Urea resins	136
PVC	1,893
Polyvinyl acetate	81
Polyvinyl alcohol	93
Celluloid	466
Cellophane sheet	1,370

Official statistics give the following for the production of plastics materials in Japan during the second quarter of 1957 (all quantities are in metric tons):

Phenolics	5,412
Urea resins	16,903
Polymethacrylate	449
Methacrylic monomer	795
Vinyl acetate monomer	9,316
Polyvinyl alcohol	3,953
PVC and copolymers	29,811
Vinyl chloride monomer	1,839
Melamine resins	1,642
Unsaturated polyester resin	763
Phthalic acid resin	2,147
Silicone Resin	156
Cellulose acetate	2,648
Caprolactum	6,467
Total	82,801

From these figures, it would appear that Japan was producing plastics and plastics materials at the rate of more than 300,000 tons a year in 1957.

Plastics Machinery in Japan

Keeping pace with the advancement in the plastics industry, the production of all kinds of machinery for processing plastics is developing rapidly in Japan; in fact, the major part of the equipment of most plastics plants now in use is likely to be of local manufacture. Fully-automatic injection molding machines, extruders (mainly of the single screw type), high-frequency welding machines, and calender rolls are all made here because of their low prices as compared with those of similar American and British articles. These parts are becoming important export items, mainly to South East Asian countries, though they are also finding their way into other parts of Asia (recently, an extruder was shipped to Mexico.)

According to a report by the Injection Molders Group, 632 injection machines with a total capacity of 3,650 ounces are in operation now in Japan. Of these, 97 units, chiefly in the 3-18 ounce range, were imported. Ten of these imported units had a capacity of over 20 ounces, and 20 were between ½-2 ounces. Of the 535 domestic machines, 144 were ½-2 ounce units; 375 were 3-18 ounce units; and 16 had capacities of more than 20 ounces.

The injection molders annually consume about 6,000 tons of polystyrene (all imported, chiefly from the United States); 750 tons of polyethylene; 550 tons of PVC; and small amounts of acrylic, cellulose acetate, and nylon resins. The main items produced were packaging and containers, radio and TV parts, electrical components, and toys.

It is understood that the Japanese Government has under consideration applications for technical collaboration between the Meiki Seisakusho Company and the American Reed Prentice Corp., and between Ikegai Tekko Co. and the English R. H. Windsor Company.

New Materials

Write item numbers on Readers' Service Card to obtain more information.

Hercules Brand Polypropylene

Polypropylene development in this country is being pioneered by Hercules Powder Co., who recently went on stream with Pro-fax. This material can be molded by compression, extrusion, or injection; although present availability is limited to the latter form. Finished parts are tough, rigid, and have a glossy surface.

Pro-fax responds well to a wide range of processing conditions. It has good flow characteristics, and can be fabricated with standard equipment and techniques. Molded shapes retain their form after cooling with a minimum of shrinkage and distortion. Though a thermoplastic material, Pro-fax has a softening point well above 100° C.

The material has been evaluated as home appliance housings, valves, bottles, laboratory and hospital ware, and as house wares. Results were uniformly excellent. A good potential is seen in the thermoforming and packaging fields, as well as in the manufacture of hot water piping. Pro-fax granules are ⅛-inch in diameter, and can be dry colored.

End products made of Pro-fax are said to have a high impact strength; good electrical properties; and are resistant to grease, oil, water, and many common acids. Some typical properties of injection-molded parts include:

Crystalline melting point, °C.	167
Specific gravity	0.901
Mold shrinkage, in./in.	0.020
Mechanical Properties at 23° C., 50% R. H.:	
Tensile strength, psi.	5,000
Modulus, psi.	155,000
Yield stress, psi.	4,970
Strain, %	15
Ultimate elongation, %	>220
Flexural modulus, psi.	170,000
Strength, psi.	8,100
Izod impact, ft.-lb./in., notched	1.02
Unnotched	>17
Hardness, Rockwell R	93
Properties at Elevated Temperatures:	
Yield stress @ 100° C., psi.	1720
Tensile modulus @ 100° C., psi.	37,000
Heat distortion temperature, 66 psi., °C.	105
Deformation under load of 2,000 lbs., 6 hrs., at 122° F.	2.0
Electrical Properties:	
Dielectric constant	2.0
Power factor	0.0003
Environmental Properties:	
Water absorption, %	0.03
Environmental stress cracking, hrs.	None

Readers' Service Item M-1

Alkyd Resin Water Emulsion

An aqueous alkyd emulsion for flat wall enamels, which is said to offer the combined advantages of solvent-type flat enamels and latex paints, has been introduced by American Cyanamid Co.'s plastics and resins division. Called Cyaqua 405-20, it is reported to be the nearest thing yet to the ideal vehicle for interior wall paints.

Like the latices, paints made with Cyaqua are odor-free, easy to apply, and can be removed, wet with ordinary tap water. Dried spots are removable with mineral spirits, turpentine, paint thinner, or nail polish remover. Like the solvent-type alkyd flats, they have high hiding power, scrub resistance, and sheen control. Containing no casein, they will not "skin" in an opened can.

Cyaqua 405-20 is produced without emulsifiers, and solids are converted by air oxidation to an insoluble film. At the same time, this emulsion does not form an irreversible solid during water evaporation—a shortcoming of many of the latex paints now available. It disperses pigments readily, and tolerates high pigment loading. Usual concentration ranges 50-55%, though coherent films can be obtained as high as 80% pigment content.

Characteristics and properties are reported as follows:

Solids content, % by weight	46-48
pH	8-9
Weight, lbs./gal.	8.8
Solids weight, lbs./gal.	9.4
Particle size, microns	<1
Appearance	Creamy

Readers' Service Item M-2

Low Temperature Plasticizer

A relatively low-cost, primary plasticizer for vinyl compounds requiring low temperature flexibility has been introduced by Emery Industries, Inc. Tradenamed Plastolein 9078 LT Plasticizer, the material is priced in the adipate range. In addition to its low temperature properties, the Emery material offers greater compatibility, higher tensile strength, lower oil extraction, and lower volatility.

Suggested applications for vinyls containing Plastolein 9078 include sheeting and coated fabrics for outdoor upholstery and outer wear, extruded items, and industrial tapes. Specifications and performance data of compounds incorporating 48 parts plasticizer to 100 parts Geon 101 resin are as follows:

Tensile strength, psi.	2,850
Elongation, %	365
Modulus, psi.	1,130
Hardness, Shore D, 10 sec.	85
Volatility, SPI, 1 day, % loss	0.9
After 7 days	4
Masland impact, failure @ °C.	—40
Heat stability @ 350°, min.	90
Extraction, water % loss	0.1
Soapy water, % loss	0.5
Mineral oil, % loss	5.5
Compatibility, Roll Spew	Slight

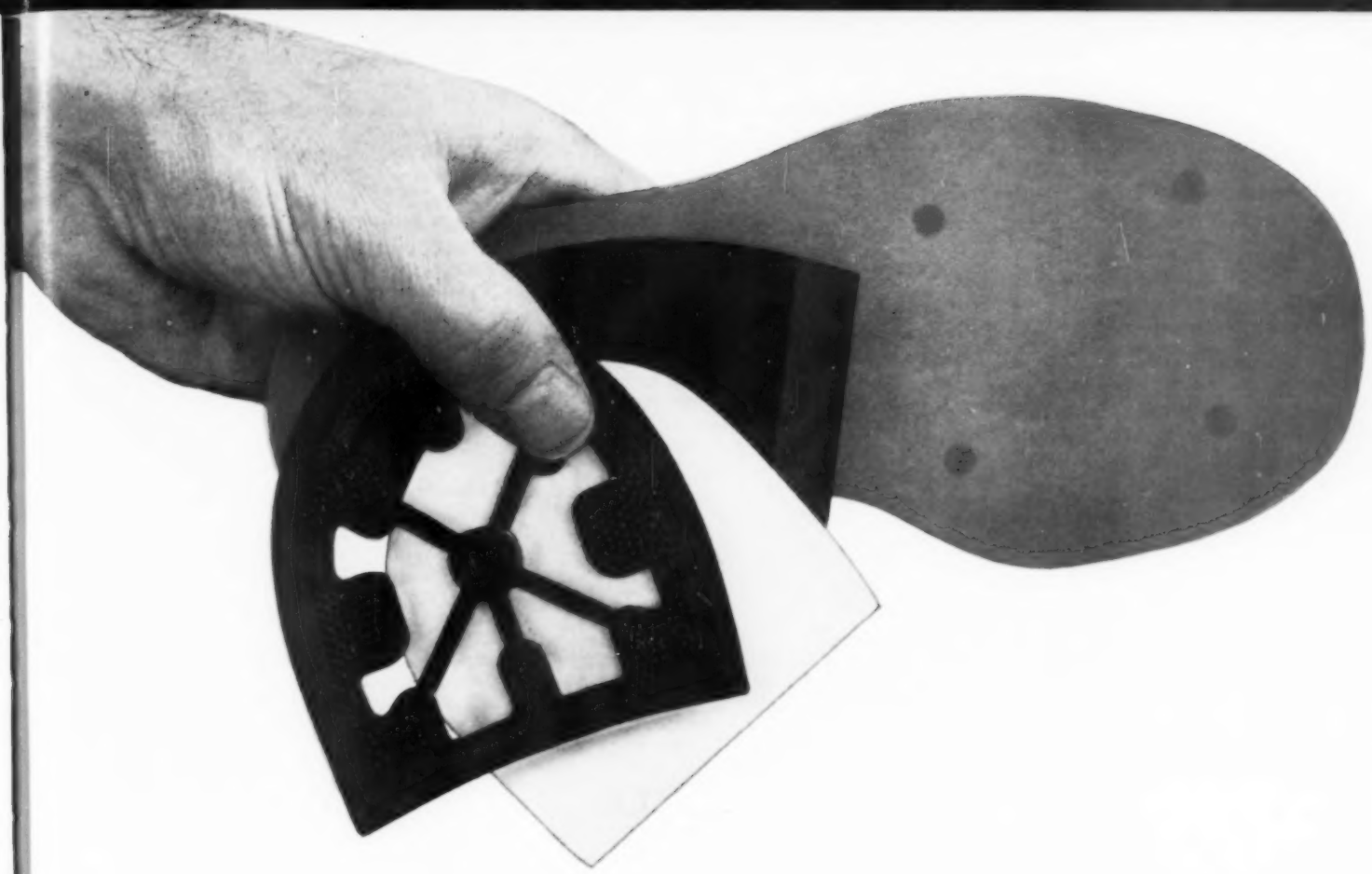
Readers' Service Item M-3

Polyester Urethane-Component

A modified glycol-polyadipate specifically designed for reacting with diisocyanates to obtain flexible polyurethane foams and films has been introduced by Rubber Corp. of America. Called R C Polyester F-1, the material has the following properties:

Acid number, max.	1.5
Hydroxyl number	58-62
Viscosity @ 25° C., cps.	10,000-13,000
Color, Gardner	5
Specific gravity	1.19-1.2
Moisture content, %	0.0

Satisfactory foams have been obtained using the following formulation: 40 parts R C Polyester F-1, 12 parts Nacconate 80 or Hylene TM, 0.1 part Emulphor



Shoe parts of **TENITE POLYETHYLENE**

offer better flexibility
easier workability
improved moisture resistance
longer life

Plastics are becoming more important every day in shoe construction. The midsole, Dutchman heel pieces, and heel base shown above, for example, illustrate new uses of Tenite Polyethylene by Endicott-Johnson Corporation, a leading name in the shoe industry.

Tenite Polyethylene is a plastic with properties useful to shoe manufacturers. It is light in weight and resists chemical attack, aging and moisture. It is easy to form; parts can be molded, or cut from extruded sheet. It can be supplied in colors.

Endicott-Johnson cite numerous benefits from their use of Tenite Polyethylene. Dutchman heel pieces, they report, formerly were made of fibre and leather. By using Tenite Polyethylene, they now have a material more adaptable to rounding and skiving, which permits production of better-fitting shoes. The new heel pieces also have greater flexibility and moisture resistance—two important considerations for any heel piece.

Their heel bases formerly were made of rubber. By switching to plastic, Endicott-Johnson feel that their new bases are more serviceable and that quality control has been made more precise.

Midsoles formerly were made of leather. Here again, the change to polyethylene has meant improvements in workability, flexibility and moisture resistance.

Today, many industries are using Tenite Polyethylene in place of traditional materials. Perhaps you, too, have a product that could be given improved performance or longer life if made of this versatile plastic. For more information, write EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

TENITE
POLYETHYLENE
an Eastman plastic

EL-719, 0.2 parts dimethylethanol amine, and one part water. The polyester and diisocyanate are mixed and allowed to form a prepolymer for about an hour. A blend of the other materials is added with rapid agitation, and the mixture is poured when opacity becomes pronounced (about 15 seconds)

Foaming can be achieved also, through the addition of diisocyanate to a blend of the other igredients and pouring within 30 seconds. Variables to be considered in the production of foams with consistent properties are the room temperature; humidity; type of mechanical mixing of the prepolymer; and the speed and thoroughness of mixing in the water, catalyst, and emulsifier.

Readers' Service Item M-4

Clear Epoxy Baking Varnish

A one-component epoxy varnish which cures on exposure to heat has been introduced by Marblette Corp., under the tradename Maraset Clear Varnish BV790. Designed for severe conditions, the material forms a 1.5-mil coating characterized by excellent adhesion to a number of materials and by outstanding chemical resistance to temperatures from —60° C. to + 200° C. The coating also is flexible and resistant to chipping and abrasion.

The varnish is ready to use as supplied; however, it can be thinned with xylene if a lower viscosity is desired. Surfaces should be clean and dry before applying BV 790, which should then be allowed to air-dry for ½-1 hour. A 20-30 minute bake at 300-325° F. furnishes the final cure. The varnish is suggested for coating brass hardware, cosmetic containers, electrical appliances, cans, drums, and as an undercoating on Kirksite for plastic tools. It also has been employed successfully as an electrical insulating coating on power resistors, motors, and transformers exposed to corrosive atmospheres at high temperatures.

Properties are reported as follows:

Weight, lbs./gal.	7.7
Viscosity, sec.	16
Total solids, by weight, %	39
Dielectric strength, short time, 0.003 mil, volts/mil.	1,100

Readers' Service Item M-5

Black Epoxy Casting Resin

A black epoxy resin which can be cast up to 12 inches in thickness without generating excessive exothermic heat has been introduced by Furane Plastics, Inc. Called Epocast 11B, the material has a pot life of about 1½ hours after the addition of Hardener 985.

For hard formulations, the suggested proportions are 10 parts by weight of hardener to 100 parts by weight of resin. Thorough mixing for 15 minutes is recommended. For soft formulation, the proportion of hardener should be increased to 30 parts. Castings will reach substantially full strength in 24-48 hours, depending upon ambient room temperatures.

Typical physical properties of an intermediate formulation (100 parts resin to 20 parts hardener) are reported as follows:

Resin viscosity @ 75° F., cps., before adding hardener	140,000
After adding hardener	25,000
Density, cured, gm./cc.	2.05
Compressive strength, psi.	5,000
Hardness, Shore D (instantaneous)	70
Shrinkage, ln./in.	0.0025
Water absorption, 2 hrs. boiling water, %	1
Machineability	Excellent

Readers' Service Item M-6

Two Epoxide Plasticizers

Two isooctyl epoxystearate plasticizers, which are reported to impart outstanding low-temperature performance and color stability to PVC, are currently available from Celanese Corp. of America. Designated Celluflexes 21 and 23, these materials also provide low viscosity and viscosity stability to plastisol formulations. Suggested applications for both include vinyl film, sheeting, coated fabrics extruded tubing and hose, slush moldings, and injection molded items.

Celluflex 21 contains about 25% less epoxide (oxirane) oxygen than 23, a factor which makes it slightly more effective for the very low temperature uses. Being less of a solvent, it excels 23 in controlling the viscosity of plastisols. Celluflex 23 is preferred where the prime considerations are color stabilization and cost.

Celluflex 21 is comparable in performance with the diester low-temperature plasticizers, yet is available at a lower volume cost. Both Celluflexes offer the additional advantage of improved stability, and may be used to replace a portion of the more-expensive, conventional stabilizers. When used in combination with tin stabilizers, however, the formulation should be checked closely for compatibility.

Both materials are more resistant to volatility loss than other monoester, low-temperature epoxy plasticizers, as shown by the ASTM test for activated carbon volatility. When used alone, they compare well with didecyl adipate except in mechanical stress, where some exudation is noted. Formulated with dioctyl phthalate or other primary plasticizers, they did not exude and otherwise compared quite favorably with the diesters.

Physical properties for the two materials are reported as follows:

	Celluflex 21	Celluflex 23
Form	Fluid	Fluid
Color, Gardner	1	1.5
Odor	Slight	Slight
Acid no., mg. KOH/gm.	0.2	0.2
Iodine no., gm. iodine/100 gm.	1.3	1.8
Oxirane oxygen, weight %	3.45	4.4
Specific gravity	0.901	0.918
Boiling point, °C.	213	226
Viscosity, cps.	21	29
Flash point, °F.	430	410
Pour point, °F.	10	—5
Freezing point, °F.	—13	—17
Index of refraction	1.453	1.457

Performance data for the materials in formulations made up of 100 parts PVC, 40 parts plasticizer, and 1.5 parts of a barium-cadmium stabilizer are tabulated as follows:

	Celluflex 21	Celluflex 23
Modulus, psi.	1,650	400
Elongation, max. %	360	2,950
Tensile strength, psi.	2,800	98
Hardness, Shore A, instantaneous	95	89
10-second delay	90	1,700

Readers' Service Item M-7

Polymeric Type Plasticizer

A high-solvating primary plasticizer with polymeric properties is currently available from Argus Chemical Corp. Designated Drapex 7.7, the material should be of special interest in homogeneous floor tile and upholstery due to its outstanding resistance to staining. Shoe polish, asphalt, mustard, red crayon, ball point ink, and lipstick have little or no effect on vinyl compounds containing this plasticizer.

Drapex 7.7 has a higher rate of solvation than most other plasticizers with polymeric properties. This means less processing difficulties. The same feature recommends it for use in plastisol—or organosol-coated fabrics, where polymeric properties are difficult to obtain due to the high temperatures required for solvating conventional polymeric plasticizers. These temperatures often scorch the fabric backing.

The low volatility and high resistance to water absorption and extraction of Drapex 7.7 plasticized compounds suggests its use in high-temperature electrical compounds for wet service conditions. On the basis of nitrocellulose lacquer-lift tests, the material is recommended for formulation requiring high mar resistance.

Properties of the material itself and of compounds containing 50 parts plasticizer to 100 parts resin are reported as follows:

Refractive index	1.504
Specific gravity	1.05
Viscosity, poises	20
Tensile strength, psi.	2,730
Ultimate elongation, %	290
Modulus, psi.	2,280
Hardness, Shore A, immediate	100
After 10 seconds	91
Volatility, 75 mil sample after 24 hrs. @ 250°F., weight loss, %	0.89
Soapy water extraction, 1% ivory soap, 20 mil sample after 24 hrs. @ 60°C., weight loss, %	0.84
Water absorption, 20 mil sample after 7 days @ 50°C. Weight gain, %	1.11
Water extraction, 20 mil sample after 7 days @ 50°C., followed by ½ hr. drying @ 105°C., weight loss, %	0.12
Oil extraction, 20 mil sample after 7 days @ 50°C., in ASTM #3 oil, weight loss, %	0.29

Readers' Service Item M-8

Two Vinyl Stabilizers

Ferro 904 is a light yellow, liquid, organic inhibitor produced by Ferro Chemical Corp., and recommended for use with metallic heat and light PVC stabilizers in rigid, calendered, molded, extruded, and plastisol formulations. It is reported to improve initial color and long-term heat stability, and is particularly beneficial where a high degree of clarity is desired.

This stabilizer can be used effectively in formulations containing phosphate plasticizers. Suggested combinations for rigid applications are 0.5-1 phr. with 2.0-3.0 phr. Ferro 1827X; calendered, molded; and extruded stocks, 0.5 phr. with 1.0-3.0 phr. Ferror 1212, 1820, 1840, or 1827X; and plastisols, 0.5 phr. with 2.0-4.0 phr. Ferro 203 or 1212.

Ferro 1212A is a mild-odored, yellow liquid, solution of barium and cadmium compounds with an organic inhibitor. It is claimed that this stabilizer produces a high degree of clarity that is retained throughout the processing cycle; provides excellent color retention in pigmented stocks; gives good heat and light stabilization; has a low sulfur stain potential; and minimizes plateout. For optimum stability in all calendering, molding, and extruding operations, one-quarter part stearic acid must be used for every part 1212A.

Readers' Service Item M-9

VANSTAY®

Vinyl heat and light stabilizers

Our trade mark of 12 years standing came into being with VANSTAY L, the first nontoxic light stabilizer for Vinyls.

Today, the VANSTAY line includes a number of materials developed to keep pace with Industry's demands for higher temperature Vinyl protection in process and in service.

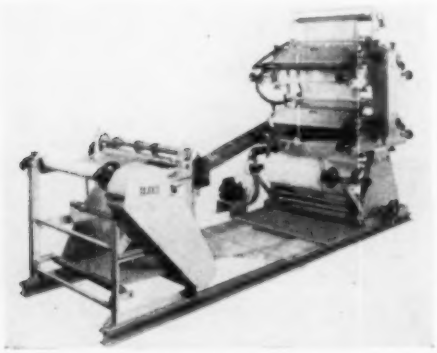
Expanded research and technical service can be of immediate assistance in solving your Vinyl stabilization problems.

R. T. Vanderbilt Co., Inc.

230 PARK AVENUE · NEW YORK 17, N. Y.

New Equipment

Write item numbers on Readers' Service Card to obtain more information.



Lee 27-inch Poly Printer

High-Speed Printing Presses

Flexographic, web-fed, printing presses now are available in units capable of handling 1-6 colors in high-speed printing of polyethylene, cellophane, foils, vinyl, Pliofilm, glassine, Mylar, paper, and other flexible materials. Sold through Lee Machinery Corp., the presses are available in widths of 15, 22, 27, and 30 inches to handle color printing when used in tandem with a total of 1-6 color presses. Printing repeats range from 6.28-35 inches. New standard equipment on all machines is an infra-red type of hot air-drying system that insures increased production. Thermostatically-controlled hot air at temperatures from 0-450° F. is blown under constant pressure directly upon the printed web without over-heating or harming the material being printed, thus permitting high operating speeds.

Other features of the machines include forward and side adjustments on the unwind stand and brake; two ink fountain rollers of bronze and rubber for each color; a plate cylinder throw-off that moves up and down away from the impression cylinder and ink rollers; splashproof, stainless steel, self-locking, covered ink fountains that are elevator-mounted for simplified up and down movements; and bronze, split-type plate cylinder bearings for quick and simple cylinder changes. All parts for the Lee Poly Printer are made in this country, and all gears are American standard 10-pitch. The standard 27-inch Printer is 53 inches wide, 70 inches long, 80 inches high, and weighs 2,300 pounds.

Readers' Service Item E-1

FINELY GROUND

MICA FILLERS

Increased strength...high impact resistance...compatible with all resins . . . and best thermal and electrical properties of any mineral filler.

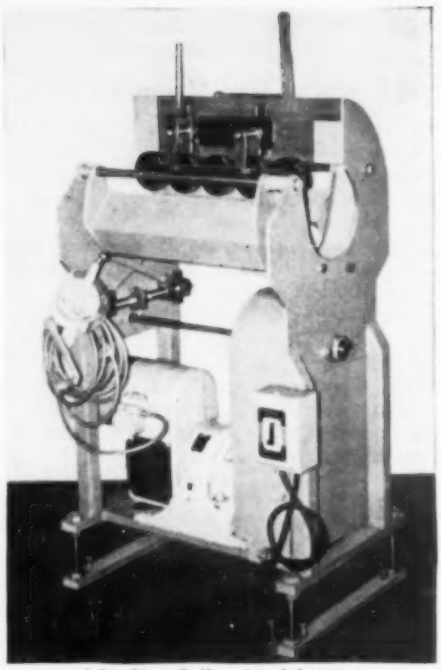
The English Mica Co.
STERLING BUILDING, STAMFORD, CONN.

Side Loading Pipe-Puller

A side loading pipe-puller that is adaptable to sizes of plastic pipe, tubing, and rod between 1/8-inch rod and six-inch coupling stock has been developed by Al-Be Industries. Designated the Model 600-4 Pipe Puller, the unit is expected to find wide application in plastic extrusion work, since extrusions must be "pulled," as well as pushed, through the extruding die in order to maintain close tolerances.

A major feature of the machine is the simplicity by which pipe may be loaded between the pull rolls, or released in the event of a jam-up. A single toggle lever opens up the roller unit, permitting the pipe to be loaded or removed through the open side. The roller system uses three sets of rollers spaced around the pipe at 120° intervals, and the pipe is supported and pulled by two of these roller sets located 60° on each side of the centerline. Each roller set consists of five Neoprene-covered rollers that are four inches in diameter and one-inch wide.

The 10 rollers in the bottom two sets are driven individually by gears and timing belts from a ½-h.p. U. S. Varidrive motor, and the motor speed can be varied from three inches to 20 feet per minute by means of a mechanical remote control located at the die. The motor belt linkage permits use of a single crank for adjusting both sets of driving rollers to handle pipes of differing sizes. Since this adjustment is always toward or away from a common center, the centerline of the Pipe Puller itself remains constant, eliminating any need for adjusting the height of the machine when changing from one pipe size to another. A scale used in conjunction with the adjusting crank indicates the approximate diameter of pipe to which the driving rollers have been set.



Al-Be Pipe Puller, Model 600-4.

The third set of rollers consists of five rubber-covered idlers that either "float" on top of the pipe or are locked in place to exert constant pressure on the driving rollers. In normal practice, the idlers are allowed to float during initial start-up when the pipe interior is likely to be uneven or distorted, and then locked into position as soon as the process has stabilized. However, the toggle lever can be thrown to lift the rollers clear of the pipe for instant release.

Experience has shown that the use of three sets of rollers (two driven and one idler) provides a minimum of distorting pressure without loss of pulling traction. As a result, the Pipe Puller is suited for use in extrusion of thin-wall pipe or tubing.

The Model 600-4 Pipe Puller is 54 inches high, 26 inches long, and 22 inches wide. Adjustable bolts at the base allow for a four-inch variation in operating height. Weight of the unit, installed, is 450 pounds.

Readers' Service Item E-2

Insulation Resistance Tester

The Vibrotest Model 250 insulation resistance tester, made by Associated Re-

search, Inc., has been completely redesigned. The new circuitry of the unit provides for accurate resistance measurements from 1-50,000 megohms by means of four overlapping ranges; 1-50, 10-100, 100-5,000, and 1,000-50,000. The center scale values are approximately 2, 20, 200, and 2,000 megohms respectively. The unit features simplicity of operation, with only two calibrating controls, two push-buttons, and a range switch.

Assured calibration is provided by a unique circuit employing five standard commercial tubes and a meter-tracking control for ready matching of meter and metering circuit to original accuracy when a tube is replaced. The regulated test potential is 500 volts, and is maintained constant within ½% throughout the four test ranges of the instrument. Accuracy is $\frac{1}{32}$-inch of calibration at any point on the scale.

The instrument has an input of 115 volts, 50-60 cycles A.C., measures 8⅞ by 6 by 8½ inches in size, and has a net weight of 14 pounds. It is furnished in a welded steel case with removable cover, carrying handle, three five-inch test leads, 5-foot line cord, and complete operating instructions.

Model 250 Vibrotest with cover attached

Readers' Service Item E-3

Carbide-Tipped Saw Blades

"Customized" carbide-tipped saw blades, made by Lemmon & Snoap, include a new member, the "Flying Cutter," which has no gullets between the teeth—the carbide teeth are simply inserted and welded into position at scientifically-determined intervals, and the blade could be termed a cutting wheel for that reason. Because of its construction, the saw does not grab the material being cut, unlike standard carbide saws.

While originally designed for use as a non-ferrous metal cutting blade, where it provides excellent results in cutting extruded aluminum, brass, and bronze, the Flying Cutter is suitable for use on plastics and wood. The blade eliminates saw-cut flash on extrusions, and can be used on extrusions down to ⅛-inch in thickness, accoustical tile, and special applications. Specifications and dimensions for

Plasticizer Data
TO HELP YOU CHOOSE THE RIGHT PLASTICIZER

this
Harflex® Plasticizer
is efficient

Dimethyl sebacate
extreme efficiency • excellent low temperature properties

Appearance	Clear Liquid or White Solid
Color, APHA	100 max.
Odor	Neutral
Specific Gravity 30/20°C	0.986±0.003
Free Acidity, as Acetic Acid	0.02 max.
Ester Content	99.0% min.

major uses:

A plasticizer in vinyl resins, synthetic rubbers, cellulose nitrate, cellulose acetobutyrate, acrylic resins; as a chemical intermediate, and a neutral, concentrated source of the sebacyl radical.

Harchem produces a full line of phthalate, adipate, sebacate and polymeric plasticizers. The Harchem Division laboratories will gladly assist you with your plasticizer problems, or will supply additional data including formulation test results and formulation suggestions for any Harflex Plasticizer.

Address inquiries to Dept. H-41

THE KEY TO HARCHEM® BETTER PLASTICS
HARCHEM DIVISION
WALLACE & TIERNAN, INC.
25 MAIN STREET, BELLEVILLE 9, NEW JERSEY
IN CANADA: W. C. HARDESTY CO. OF CANADA, LTD., TORONTO

MERCHEN GRAVIMETRIC FEEDERS & METERS

for dry free-flowing materials

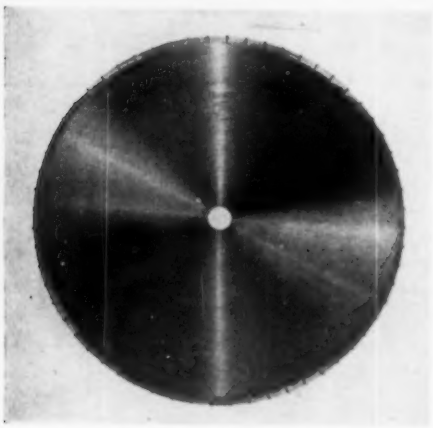
- automatic batch control
- continuous blending
- materials accounting

Accuracy 1%
Rates 3 to 3000 lbs. per min.

Write for Bulletin No. M-32

M-32

WALLACE & TIERNAN
INCORPORATED
25 MAIN ST., BELLEVILLE 9, N. J.



Flying Cutter saw blade.

the blades depend on the size of the cutting machine in which they are to be used, and the blades can be made in any size and any dimensions where normal abrasive wheels can be used.

Readers' Service Item E-4

Controlled-Heat Brander

"A "controlled heat" brander, Acrohex Brander No. 573, has been developed by The Acromark Co. The unit utilizes a temperature controller and a thermometer mounted on the die holder to allow perfect brand markings by means of low-temperature branding on thermoplastics (either colorless markings or with foil to provide color), and higher temperature branding of thermosetting plastics. The brander has interchangeable dies and type holders, and a baffle plate heat deflector between the handle and die in order to maintain a cool handle on the tool.

The tool is furnished with an extension cable that plugs into any 110-220 volt A.C. outlet, and comes in sizes ranging from 90-700 watts. By using the firm's Acroleaf Transfer Foil, the tool can be used to make color-bonded imprints directly on plastics. All colors are available, including black, white, gold, and silver.

Acrohex Brander No. 573 with accessories

Readers' Service Item E-5

Pneumatic power saw and file

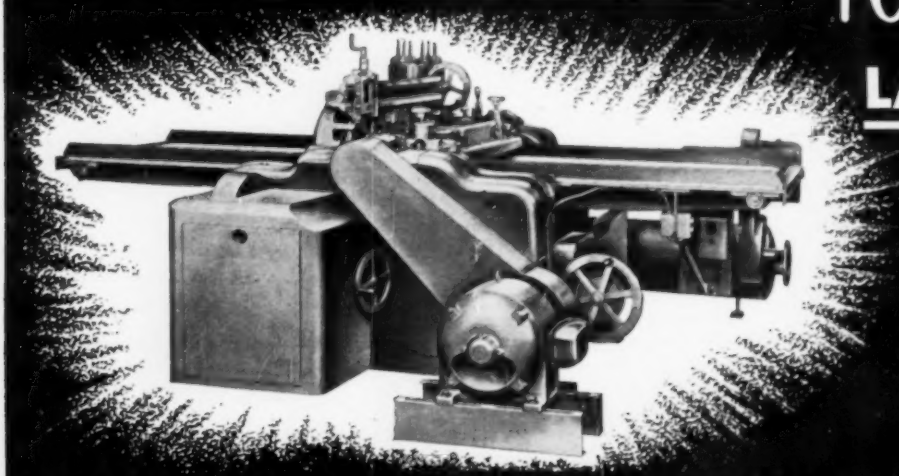
Portable Power Saw

A portable pneumatic power saw and file that quickly and easily does highly satisfactory key-hole, dead-end, and scroll cutting of plastic materials has been developed by Air-Speed Tool Co. The tool has been proved by months of intensive testing under all sorts of on-the-job conditions involving rigid vinyls, cellulose acetate, polystyrene, fiber glass-reinforced plastics, Plexiglas acrylic, and other hard thermosets and thermoplastics.

Operating speed and cutting stroke of the saw are easily adjusted. The tool is fully warranted, and has only two moving parts which means extra long saw life

Readers' Service Item E-6

BUSS MICRO-SURFACER a Revolutionary PATENTED **LARGE-VOLUME SIZER**



INSURES UNIFORMITY with PRECISION ACCURACY... .001" TOLERANCE, VASTLY INCREASED PRODUCTION

Eliminates dirt and grit. Handles thick or thin materials up to 50 inches wide with sufficient H.P. for sizeable cuts. Provided with variable feed suitable for a wide range of materials. Built-in knife grinder and other features for minimal maintenance.

OF RUBBER and VINYL FLOORING

★

RUBBER COMPOSITION and KINDRED PRODUCTS

★

EXTRUDED, MOLDED and LAMINATED PLASTIC SHEETING

★

VERY THIN FLEXIBLE and HIGHLY ABRASIVE MATERIALS

★

This machine, if applicable to your production, can save you many thousands of dollars through faster, better processing. Let us consult with you concerning any possible application.

BUSS MACHINE WORKS *Planer Specialists Since 1862*

325 EIGHTH STREET, HOLLAND, MICHIGAN

Plastics Applications

Write item numbers on Readers' Service Card to obtain more information.

Vacuum-formed plastic game boards offer both eye appeal and utility.

Three-Dimensional Game Boards

Brilliantly colored, easily cleaned, durable game boards of Campco Registrite, a high-impact styrene sheet material especially made for print-register applications by Chicago Molded's Campco division, are available from W. H. Schaper Mfg. Co. Games include Tickle Be, Black Ball Express, Put & Take, Chicken, and Quarter-After. One is played with plastic chips on vacuum formed inserts, and several of the others involve additional plastic parts.

Readers' Service Item P-1

Tiny Polyethylene Floats

Evaporation losses of volatile solutions may be cut as much as 75% through the use of Mini-Vaps, miniature floats of polyethylene foam made by American Agile Corp. These tiny floats are star shaped to assure better surface coverage, and contain thousands of closed air cells making them both lightweight and buoyant.

Tiny polyethylene floats cut evaporation.

Chemically inert, Mini-Vaps neither contaminate a solution nor are they affected by it. Eastman Chemical supplies the Tenite polyethylene used in this application.

Readers' Service Item P-2

Reinforced-Plastic Plane Skis

Aircraft skis, made from fibrous glass-reinforced polyester resins by Airglas Engineering Co., are finding wide application with Alaskan and Canadian bush pilots. Known as the Landes Fiberglas Aircraft Ski, they are approved by CAA for shock resistance under high loads. Offered in four sizes, they combine lightness of weight and weather resistance with freedom from "freeze-down" and sticking under varied snow conditions. Polyester resins used in this application are Plaskon, a product of Allied Chemical & Dye Corp.'s Barrett division.

Alaskan plane uses reinforced plastic skis.

Readers' Service Item P-3

Prefab Jacketed Pipe Conduit

Low-cost, prefabricated pipe conduit with a two-ply reinforced plastic jacket has been introduced by Temploc, Inc. Designed to protect underground steam and hot water systems from corrosion, it is said to offer several advantages over the corrugated galvanized steel and tar conduits formerly considered standard.

The protective shell is made by building up two plies of spirally-wrapped glass cloth and American Cyanamid's Laminac polyester resin over a sheath of kraft paper. Initial cost of the Temploc conduit is reportedly 20% less than steel. Its weight is about 50% less than steel, and 25% less than tar coatings. Actual weight for a

STATIC??

For smoother product flow unhampered by troublesome static, investigate the IONOTRON. This compact device, specially adapted to your own production equipment, ionizes the air in the immediate vicinity of the static charge, thereby causing neutralization of the static. The IONOTRON requires no electrical connections and, because of its unique construction, can be readily installed on equipment at the point of greatest disturbance. U. S. Radium engineers will consult with you on specific installation and application problems.

THE STATOMETER . . . . . . an instrument for detection and measurement of static disturbances. If static is your problem, the STATOMETER can readily provide information as to its source, intensity and polarity. Write for Bulletin 20.61.

UNITED STATES RADIUM CORPORATION

MORRISTOWN, N. J.

Offices: Chicago, Illinois and No. Hollywood, Calif. Affiliates: Radelin-Kirk, Ltd., Toronto, Canada and United States Radium Corp. (Europe), Geneva, Switzerland

RADIUM

Temploc prefabricated insulated pipe.

8-inch section is 31 pounds per foot.

The insulation is sealed and vapor-proofed at the time of manufacture by extending the outer shell over the end and bonding it directly to the bare pipe. Temploc supplies its insulated pipe and fittings in sizes custom-cut to specifications. The outer covering can be applied to any type of insulation and pipe.

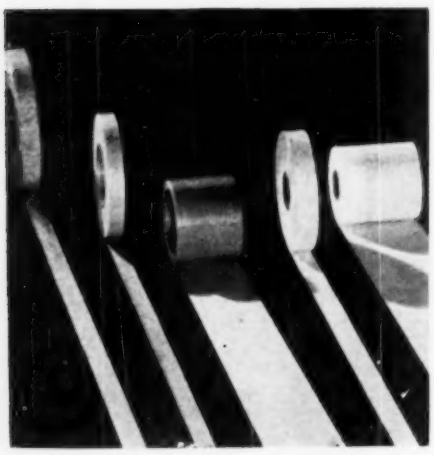
Pipe up to 5-inch width can be installed without use of a crane under normal conditions. Units are numbered for ease of installation, and provisions have been engineered into the system for expansion and contraction. Factory supervision is provided at the site.

The conduit has been installed successfully in most western states. Recently, Temploc furnished 22,000 feet of conduit at Yellowstone National Park connecting steam and hot water from central boilers to a number of administration buildings and cabins.

Readers' Service Item P-4

Cementable Fluorocarbon Tape

A complete line of cementable Teflon tapes, with and without a reinforcement of finely woven glass cloth, has been placed on the market by Continental-Diamond Fibre Corp. The reinforced tapes differ from the unsupported in that the glass cloth gives greater abrasive resistance, higher tensile strength, lower cold flow, improved dimensional stability, and superior mechanical properties.



Supported and unsupported Teflon tapes.

Teflon, a tetrafluoroethylene resin produced by E. I. du Pont de Nemours & Co., Inc., has presented bonding problems in the past. The new tapes can, however, be bonded with ordinary adhesives to practically any surface. Widths range from ¼-12 inches, and thicknesses range from 2-60 mils. Either or both surfaces are treated for adhesion.

Among the possible applications for the tapes are the lining of guide rails, heat sealing equipment and hoppers, and the handling and packaging of many different materials. Advantages offered include low coefficient of friction, chemical resistance, and temperature tolerance.

Readers' Service Item P-5

Fluorocarbon Laminate Lining

Ordinary equipment can be converted to corrosion service with Kel-F Laminate, Garlock Style No. 9574, a product of United States Gasket Co. This firm takes Minnesota Mining & Mfg.'s Kel-F fluorocarbon material; bonds it to a glass-cloth backing for maximum adhesion; and welds the seams to produce a continuous, impregnable lining material. It cements readily with any commercial adhesive to any material of construction.

Rectangular tank lined with Kel-F Laminate for furfuryl alcohol service.

The lining material is supplied in sheet sizes up to 36 by 42 inches. Standard weight laminate is 20-30 mils thick with the Kel-F accounting for 10-12 mils of the thickness. It can be adapted to almost any contour, from the simple planes of rectangular plating tanks to the compound curves of reactors involving flanged pipe and connections and dished pressure heads. Its thermoplasticity allows it to be drawn and stretched over these surfaces by hot- and cold-drawing techniques.

Equipment can be lined in a certified applicator's shop or in the user's own plant with equal ease. The surface to be lined is roughed; the laminate is cut and fitted; adhesive is applied to both surfaces; laminate is held securely in place while the adhesive sets; thermal pulse sealing is applied to the seams between adjacent sheets of laminate; and the finished surface is tested electrically for leaks.

Among the lining and surfacing applications suggested for the laminate are the following: tank trailers and cars, vessels, reactors, mixers, vats, drums, pails, piping, chutes, hoppers, fume hoods, ducts, laboratory benches, floors in corrosive areas, shields, splash boards, conveyors, casting forms, and foam rubber molds.

Readers' Service Item P-6

Epoxy Tool-Repair Kit

An easy-to-use repair kit for tools and castings, based on epoxy resins, has been introduced by Houghton Laboratories, Inc. Called the Hysol 6-C Epoxi-Patch Kit, it consists of two flexible tubes containing resin and hardener. Equal length beads from each tube insure a correct mixture, and the resultant gray paste cures at room temperature.

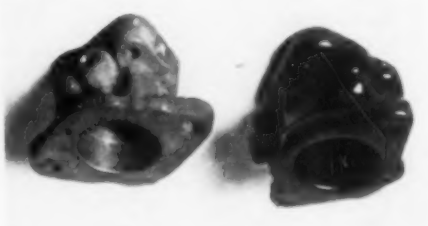
The epoxy compound fuses to ferrous and non-ferrous metals, glass, ceramics, and most plastics. Complete hardening occurs in 1-2 hours, but may be accomplished in a matter of minutes by the application of low heat. Waste is eliminated, since only enough material for a specific job need be mixed at one time. Repairs can be made in place, thus eliminating down time and costly disassembly.

Readers' Service Item P-7

Strip-Off Plastisol Coating

The chemical processing division of Auburn Button Works, Inc., now offers a strip-off PVC plastisol coating for protecting metal parts and products. Designated 105-75-P, the material is low in cost and can be applied by unskilled employees. Parts are heated and dipped to obtain a film coating of any desired thickness.

The resultant coating protects articles in shipment and/or during warehousing. In addition, it offers defense against oxidation, rust, and corrosion. Waterproof, it has high thermal and electrical insulating properties.



Cast iron part after coating (left), and after coating has been stripped (right).

Readers' Service Item P-8

"A challenge to all of us"...

a statement by ***Robert B. Anderson,*** *Secretary of the Treasury:*

"The ownership by 40 million citizens of over 41 billion dollars in Series E and H Savings Bonds is a striking testimonial of confidence in America's bright future. It means security and opportunity for millions of families —a way to provide for children's education, the building of new homes, or more comfortable retirement.

"America benefits, too, from such widespread savings bonds ownership. This partnership of individual citizens in their government's fiscal operations means better management of the public debt—greater stability for our money—brighter prospects for the years ahead.

"Our country *needs* more savings—in all forms, including U.S. Savings Bonds—to help finance our growing economy; to pay for the plants and tools that mean more and better jobs for our ever-increasing population.

"Meeting this need is a challenge to all of us. Americans everywhere should be encouraged to regularly put aside part of their earnings for future needs. And certainly part of that saving belongs in the now better-than-ever U.S. Savings Bonds."

The United States Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the Advertising Council and

PLASTICS TECHNOLOGY

Series 200 Ascor-light for on-the-spot photos.

Phenolic-Housed Photo Lamp

The Series 200 Ascor-light is now available to fill most lightweight, hand-held lighting needs for photography. Marketed by American Speedlight Corp., all models feature precision-molded battery cases of Durez phenolic resin. Molder for this application is Accurate Molding Corp.

The various models use either dry cell battery or AC power. Corrosion resistant, they withstand rough weather and treatment without losing their glossy finish. Accessories include carrying strap and belt clip, angle reflectors, side-lighting units, extension cords, phototubes, and battery testers.

Readers' Service Item P-9

Plastic Furniture Supports

One of the most vexing problems in the care of all types of resilient flooring is the prevention of marks caused by static or moving furniture loads. Previously, manufacturers have enlarged the furniture support area, with attendant deformation, creep, and/or irregular patterns of surface contact. Childlore Corp., using Bakelite's C-11 modified styrene, has come up with two possible solutions.

Carpetmates, designed to protect carpet pile from permanent marks or indentations, have blunt teeth which press aside the tufts of fabric without piercing the backing. Several types are available: multi-purpose for brass tipped modern furniture; heavy duty, for sofas and cases; and tack-on, for light, small-legged furniture.

Floormates, available round or square, are designed to protect vinyl and rubber tiling. They are available as non-skid or sliding, according to customers' wishes. Depending upon size, they can accommodate and apportion loads of 300 and 600 pounds per set.

Cup-shaped Carpetmate support protects rug piling from metal-tipped furniture legs.

Both supports have the toughness and high flexural strength to hold their shapes under heavy loads, even in direct sunlight. Lightweight, they resist corrosion and staining by chemicals contained in furniture polishes and cleaners. Four furniture-matching colors are available: clear, blonde, and brown.

According to Childlore, C-11 was chosen over such other plastic materials as nylon and high-density polyethylene for a number of reasons. Nylon proved excellent in tests; however, its higher price and lack of real advantages over C-11 in this application negated its choice. The rigid polyethylenes were just not rigid enough, and the percentage of creep was too great for the load-bearing teeth

Readers' Service Item P-10

Vinyl Anti-Vibration Pads

A compact, machine mounting pad for reducing noise and vibration is available from Clark-Cutler-McDermott Co. Called the Air-Loc, the pad is composed of B. F. Goodrich's Geon vinyl resin, sisal, and granulated cork. An outstanding feature of the pad is its integrated cross-grid embossing, which eliminates the need for cementing or bolting in most cases.

The vinyl binds the other two materials and makes the pad resistant to water, oil, grease, most acids, and alkalis. Even after repeated loadings to 1,000 pounds, the pad recovers 99% of its original thickness. Longer machine life and improved machine performance are attested.

Readers' Service Item P-11

A high molecular weight adipate plasticizer!

RC

POLYMERIC BGA

Recommended for use in PVC compounds requiring a primary polymeric plasticizer with outstanding performance qualities such as:

★ Resistance to extraction
★ High rate of solvation
★ Low order of volatility
★ Migration resistant
★ Heat and light stability

Check RC POLYMERIC BGA in wire insulation compounds, gaskets, vinyl-metal laminates, and non-migrating film and sheeting!

WRITE FOR SAMPLES! We'll send you a brochure on all RC products that can speed your operations, improve your products.

RUBBER CORPORATION OF AMERICA

READY . . . RELIABLE . . . RC, SERVING AMERICAN INDUSTRY, SINCE 1930.

New South Road, Hicksville 6, N. Y.

Sales Offices: NEW YORK • AKRON • CHICAGO • BOSTON

New Literature

Write item numbers on Readers' Service card to obtain copies.

"150 Successful Containers." Harkins Affiliates, Inc. 8 pages. As implied by the title, this brochure is actually an illustrated catalog of stock boxes available in plastic. Listing is by size and style.

Readers' Service Item L-1

"A New and Complete Laminated Plastic Service." Formica Corp. 8 pages. Four services are described: application engineering, research, fabricating, and customer stock service.

Readers' Service Item L-2

"Pioneer in Petrochemicals Products Service." Enjay Co., Inc. 4 pages. Specifications are given for Enjay alcohols, olefins, diolefins, ketones, acetates, and ethers.

Readers' Service Item L-3

"Koppers—The Company, Its Products and Activities." Koppers Co., Inc. 32 pages. This illustrated booklet gives a history of the company, describes its various divisions, and lists sales offices and plants.

Readers' Service Item L-4

"1958 Guide—Dow Corning Silicones." Dow Corning Corp. 15 pages. Various applications of silicone materials are described in this illustrated booklet.

Readers' Service Item L-5

"Naugatuck Plastics." United States Rubber Co., Naugatuck Chemical Div. 6 pages. A condensed catalog and resin guide, this illustrated brochure tabulates the physical, chemical and electrical properties of Kralastic, Vibrin, and Marvinol.

Readers' Service Item L-6

"PVP" Antara Chemicals, General Aniline and Film Corp. 48 pages. Physical and chemical properties of a high molecular weight polymer, polyvinylpyrrolidone, are described in this booklet.

Readers' Service Item L-7

"Hanna Flo-Pilot Valves." Cat. 262. Hanna Engineering Works, Inc. 6 pages. This bulletin describes and illustrates five basic pilot-valve models that are used for remote control of master valves, directional control of small single acting cylinders, and for shut-off. Specimen manual, automatic, and semi-automatic control circuits are diagrammed.

Readers' Service Item L-8

"Type C Calibrator." Allegany Instrument Co., Inc. 4 pages. This pamphlet discusses and illustrates an instrument used in the calibration of wire strain gages, their transducers, and thermocouples.

Readers' Service Item L-9

"Grex From Baton Rouge." W. R. Grace & Co. 12 pages. This illustrated brochure describes the development history of the company's high density polyethylene plant in Louisiana. Included in a flow diagram showing the basic process steps employed.

Readers' Service Item L-10

"Let Wink Aid Your Automation." No. 101. F. J. Fink & Co. 4 pages. This illustrated brochure describes the Wink basic cutter and the attachments that can be incorporated to integrate the unit into an automated system.

Readers' Service Item L-11

"Pfaudler Heat Exchangers and Condensers." No. 949. The Pfaudler Co. 27 pages. Supplemented by installation sketches, this booklet describes applications of heat exchange equipment in the process industries, discussing performance, thermal design, velocity limitations, film coefficients, and many other factors.

Readers' Service Item L-12

"The Story of Diamond Chemicals." Diamond Alkali Co. 32 pages. Fourteen major chemical products or product-groups are discussed in digest form in this illustrated booklet.

Readers' Service Item L-13

"Geon Resins for Gramophone Records." TB. No. G.14. British Geon, Ltd. 13 pages. This booklet traces the development of vinyl materials in record production and describes compounding and fabricating procedures for Geon 425, a vinyl copolymer resin specially formulated for this purpose.

Readers' Service Item L-14

"Color Code and Calibration Chart for Thermocouples and Extensions." Thermo Electric Co., Inc. Charted on one side of this 8½ x 11-inch card are wire calibrations with corresponding Thermo Electric and I.S.A. symbols; and color codes for I.S.A. and all types of MIL-Spec. wire. The reverse side tabulates resistance values for standard pyrometer wires in ohms per 100 feet at 68°F.

Readers' Service Item L-15

"Chemically Blown Pliovic AO Foams." TBF 57-86. Goodyear Tire & Rubber Co., Inc. 4 pages. This pamphlet relates processing methods, stabilizers, plasticizers, fillers and additives, and blowing agents that may be used with its Pliovic AO copolymer dispersion resin.

Readers' Service Item L-16

"Monsanto Opalon 410." No. 1034. Monsanto Chemical Co. 28 pages. Contained in this brochure is a description of vinyl plastisol preparation and processing methods. Curves and charts are used to show how plastisol viscosities are affected by compounding with various types and concentrations of fillers, plasticizers, pigments, stabilizers, surfactants, and diluents.

Readers' Service Item L-17

"Small-Case Temperature and Pressure Instruments." Catalog 51-1450. Fischer & Porter Co. 15 pages. This catalog describes the Series 1450 line of instruments used for indicating, transmitting, and controlling pressure and temperature.

Readers' Service Item L-18

"The Dexter-Conde Dri-Air Pump." The Dexter Folder Co. 4 pages. Three models of the company's oil-free, rotary vane pump for vacuum and pressure applications are described.

Readers' Service Item L-19

"SD Case Histories: PVC." Scientific-Design Co., Inc. 8 pages. This bulletin describes the company's suspension process for the manufacture of PVC resins.

Readers' Service Item L-20

New Literature (Cont'd.)

"Solid Solution Plastic Fluors in Massive Sizes." FL-201. Cadillac Plastic and Chemical Co. 4 pages. This pamphlet describes scintillation characteristics, chemical composition, and typical applications of a new plastic fluor. Included are data on light output efficiency, wave length of emissions, decay time, and self-absorption.

Readers' Service Item L-21

"Plastolein 9078 LT Plasticizer." No 401. Emery Industries, Inc. 3 pages. This bulletin gives tentative specifications, performance data, and results of a Florida aging study of a new low temperature vinyl plasticizer.

Readers' Service Item L-22

"Weigh Your Tanks for Best Results." Bulletin 571. The A. H. Emery Co. 4 pages. This illustrated pamphlet describes the company's weight indicating, recording, printing, and control instrumentation for tank weighing systems.

Readers' Service Item L-23

"Plastics Properties Chart." General Electric Co. 2 pages. Physical properties of Lexan polycarbonate resin are compared with 12 other thermoplastic molding materials.

Readers' Service Item L-24

"This is GRC." Gries Reproducer Corp. 1 page. This leaflet describes the company's facilities for automatic, high speed, mass production of small, precision parts.

Readers' Service Item L-25

"Amveco Asbestos Fibers for Reinforcement of Plastics." World Commerce Corp. 4 pages. This pamphlet deals with the use of asbestos fiber in reinforced polyester molding compounds giving formulations, physical properties, and applications.

Readers' Service Item L-26

"Accu-Cast." Manco Products, Inc. 4 pages. This illustrated folder describes the Accu-Cast method of precision-casting mold and die components in steel and other castable metals direct from expendable original patterns. This would eliminate the costly and time-consuming machining of steel master hobs. Accu-Cast applications include molds for compression and injection molding, extrusion dies, steel hobs for pressure casting, die inserts, foundry pattern inserts, and molds for forming rubber and glass.

Readers' Service Item L-27

"Lamart—Where Laminating Is an Art." Lamart Corp. 4 pages. New developments such as triple lamination and aluminized butyrate thermoforming sandwiches are described along with the firm's standard laminate line and its custom laminating services.

Readers' Service Item L-28

"Mono-Seal, the Scientific Protective Coating." Mono-Seal Products. 12 pages. Properties and applications of Mono-Seal, a coating formulated from silicones and epoxies, is described in this illustrated brochure.

Readers' Service Item L-29

"Marcolite Skylights." No. 12-j. The Marco Co. 11 pages. This illustrated brochure contains design data, construction features, and specifications of the firm's aluminum and fiber glass paneling.

Readers' Service Item L-30

"Specifications and Characteristics of Fatty Acids." Emery Industries, Inc. 4 pages. A section of the "Emeryfacts" series, the booklet covers the company's complete line of fatty acids. Included is a list of all the current technical literature available.

Readers' Service Item L-31

"Drapex Plasticizers." Technical Bulletin 3. Argus Chemical Corp. 22 pages. This bulletin gives detailed data on properties, performance characteristics, and recommended uses for monomeric epoxy plasticizers, Drapex 3.2 and 4.4.

Readers' Service Item L-32

"Conversion Factors." Precision Equipment Co. 1 page. This wall-chart contains many conversion factors that are difficult to locate in reference manuals. The factors are listed alphabetically beginning with: atmospheres to centimeters Hg., and ending with watt-hours to B.T.U.'s.

Readers' Service Item L-33

"Hydrotherm, Liquid Heat Transfer Systems." Bulletin 200. American Hydrotherm Corp. 11 pages. This illustrated booklet offers pertinent information on high temperature heating and cooling systems for industrial process applications. Included are performance curves for various thermal liquid heating media.

Readers' Service Item L-34

"1,687 Reasons Why You and Your Company Should Support the American Standards Association." American Standards Association, Inc. 32 pages. The reasons are actually the 1,687 standards approved by ASA in almost every field of the American economy. An example is given: it would cost an individual company about $500,000 to develop two standards that it can buy from the association for $4.50.

Readers' Service Item L-35

"Genthane-S." GT-1. Chemical division, General Tire & Rubber Co. 20 pages. Properties, cure, compounding variables, thermal stability, solvent resistance, and other data are listed for this polyurethane elastomer.

Readers' Service Item L-36

"Rhoplex AC-33 for Exterior Paints." Progress Report 4. Rohm & Haas Co. 56 pages. Physical properties of the material, test program results, suggestions for exposure studies, actual paint manufacture, lab-controlled tests, and large scale applications are covered in this illustrated booklet.

Readers' Service Item L-37

"Physical Properties of Synthetic Organic Chemicals." F-6136. Union Carbide Chemicals Co. 28 pages. A guide to Carbide's products and services, this booklet tabulates physical property data of more than 350 organic chemicals.

Readers' Service Item L-38

"What do You Mean 'Specific' Taps." Detroit Tap & Tool Co. 20 pages. This booklet tells how to get longer tap life and better performance when tapping different materials such as steels, cast iron, zinc, brass, and plastics.

Readers' Service Item L-39

"Synthane Metal-Clad Laminated Plastics." Synthane Corp. 6 pages. This folder describes six widely-used grades of metal-clad laminates for use in printed circuitry. Detailed tables list strengths, properties, and dimensions for the four paper-base and two woven-glass fabric-base materials.

Readers' Service Item L-40

"Cadet Organic Peroxides." Cadet Chemical Co. 7 pages. Peroxides covered are benzoyl peroxide, lauroyl peroxide, Cadox MDP, Cadox BDP, Cadox BSD and BSG, and Cadox BTP.

Readers' Service Item L-41

"Industrial Stock List of Formica Laminated Plastics." Formica Corp. 12 pages. This little booklet serves as an up-to-date file on the laminated plastics carried regularly in stock by Formica.

Readers' Service Item L-42

Book Reviews

"Source Book of Industrial Solvents. Volume 2: Halogenated Hydrocarbons." Ibert Mellan. Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Cloth, 6 by 9 inches, 271 pages. Price, $7.00

This second in a series of four volumes presents information on halogens, fluorinated hydrocarbons, chlorinated hydrocarbons, iodinated hydrocarbons, and brominated hydrocarbons. Commercial and proprietary names for the solvents are used, instead of purely chemical nomenclature. The solvents are classified in accordance with their distillation ranges, and a wide spectrum of properties is given in tabular form for each solvent. In addition to the tabulations of properties, many diagrams are used to illustrate the text, and the volume concludes with appendices giving references (or bibliography) and a subject index. Since the volume presents organized, compact data on the solvents of greatest practical value, it should be of great value to every individual and industry concerned with the manufacture and use of solvents.

"Polyethylene." Theodore O. J. Kresser. Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Cloth, 5 by 7½ inches, 229 pages. Price, $4.95.

This book is No. 1 in the Reinhold Plastics Applications Series, and the author is a technical service representative for Spencer Chemical Co., Orange, Tex. The book gives a brief summary of the status of polyethylene applications at present, with a little history and projection to bring it into reasonable perspective. No space has been given to ethylene polymers that are not plastic materials in the generally accepted sense, although many have been produced.

The volume consists of nine chapters covering introduction and history of polyethylene; general properties; basic chemistry of polyethylene; manufacture; processing; film and coating applications; applications of polyethylene pipe, coated wire, and miscellaneous extrusions; applications of polyethylene moldings, blown bottles, vacuum formings, and pieces made by miscellaneous processes; and future prospects for polyethylene applications. A brief subject index is appended, and the text of the volume is illustrated with many photographs, diagrams, and tables of data. While particular attention is given to the needs of the non-technical reader, the volume should prove of value to the plastics technical man with little information on polyethylene and to the non-plastics technologist who can utilize polyethylene in his field for product improvement.

"Career Satisfactions of Professional Engineers in Industry." The Professional Engineers Conference Board for Industry, in cooperation with The National Society of Professional Engineers, 2029 K St., N.W., Washington 6, D. C. Paper, 6 by 9 inches, 84 pages. Price: NSPE members, $1.50; non-members, $3.00.

This is a research report for the Conference Board developed by The Public Opinion Index for Industry, Opinion Research Corp. The report presents findings based on intensive "depth" interviews of 265 engineers, some at home and some at the job, with 11 companies who are among the top 200 largest corporations in the United States. The engineers' replies were given fully and anonymously, and the companies involved were in the aircraft, automobile manufacturing, chemical, electronics, electrical machinery, heavy equipment, petroleum refining, and rubber industries.

Detailed tabulations are given of the interview replies. The engineers themselves are shown to have broad agreement on the basis of a satisfactory career, namely: a job that is challenging and related to their talents; one that has advancement opportunities; and adequate financial reward. Enthusiastically supported is a wide range of non-financial marks of importance, including keeping them informed; asking for their ideas on relevant matters; identifying their names with their work; and showing them how their work fits into the total picture of the company's function and status. The detailed results of the survey are of great interest to all engineers, and make fascinating reading.

"Plastic Moulding." R. B. Bennett, University of Florida for Air Force Armament Center, Feb. 1957. Order PB 131400 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 211 pages. Price, $5.50.

A final report of Task 5, a three-year project, conducted by the University of Florida to assist the Center in using macro-molecular materials. The report discusses developments in new materials, techniques, and objects of construction with industrial applications. Developments in three major studies are described, together with the results of a number of sub-tasks.

A major advance was the development of techniques and equipment for vacuum molding of plastic sheets in a variety of forms valuable for strength, optical quality, and low air resistance when used as instrument enclosures. These forms also were superior as original molds for glass-polyester enclosures. New simplified, relatively inexpensive techniques and equipment were devised for molding contact-pressure glass-polyester laminates with smoother surfaces. A new scientific method was developed to replace the "rule of thumb" technique commonly used commercially for control of the cure of glass-polyester laminates.

"Mechanical Properties of 422-J Bacfoam Core for Sandwich Construction." P. M. Jenkinson and E. W. Kuenzi, Forest Products Laboratory, U. S. Department of Agriculture, for Wright Air Development Center, April 1957. Order PB 131077 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 16 pages. Price, $0.50.

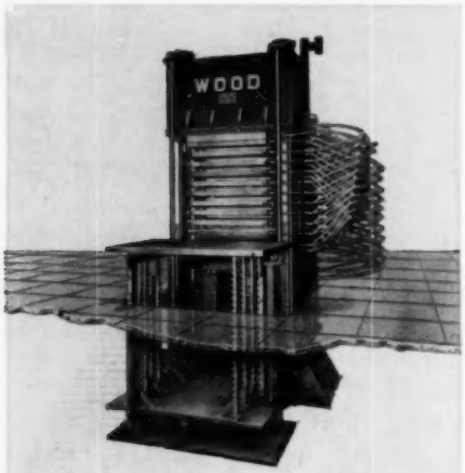
Foamed-in-place cores of sandwich constructions used in high-speed aircraft and guided missiles need considerable rigidity and strength under high temperatures. In this study, sandwiches with a foamed-in-place epoxy-phenolic resin core (Boeing 422-J Bacfoam type IA) were subjected to edgewise compression and flexure tests to determine their suitability for aircraft construction. Flatwise compression tests also were run on the core.

Among the results, it was shown that strength properties of the core depend on the size of the core air voids. Coarse-textured core was about 60% as strong as fine-textured core in flatwise compression, but coarse-textured core was slightly stronger in shear. Edgewise compressive strength of the sandwich at 500° F. was about 60% of the strength at room temperature.

"Low Temperature Condensation Process for Producing More Highly Cross Linked Alkyd Diisocyanate Foams." H. R. Moore, U. S. Naval Air Development Center, Jan. 1956. Order PB 131123 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 110 pages. Price, $2.75.

A low-temperature mixing process was developed for up-grading the physical properties of rigid diisocyanate foams. The process was based on a typical foaming resin (Selectron 5922) and aromatic diisocyanate (2,4-toluene diisocyanate). Among its advantages, the process prevents attainment of post-gelation temperatures above 285° F. that might damage thick sections of foam because of poor conductivity. The process gives reproducible values in foam product properties for batches of varying sizes, and may be applied to making 100 pounds or more of condensate in one operation.

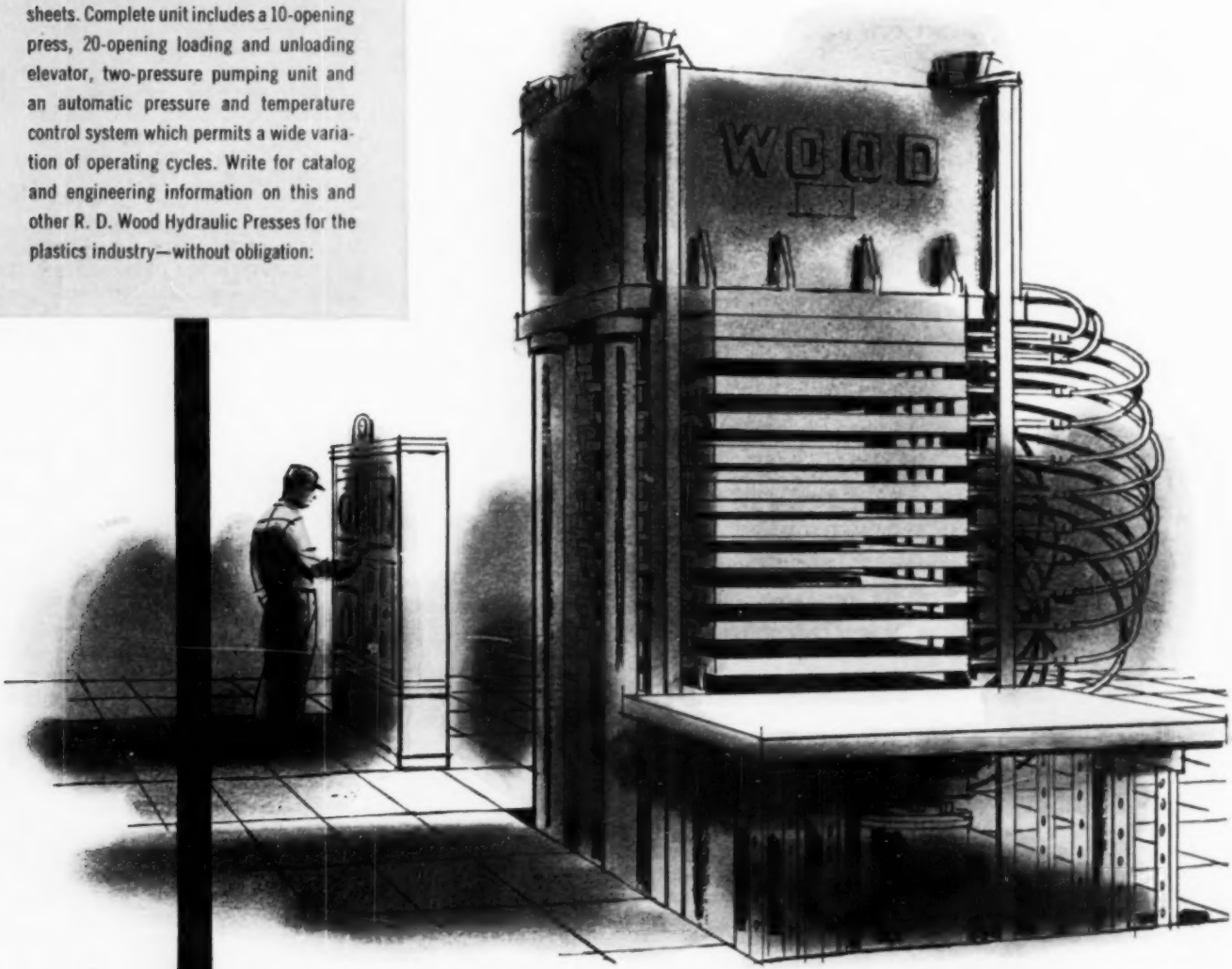
The resulting foams are shown to be improved, with a direct correlation in the degree of completion of both primary and secondary cross-linking reactions in the liquid state. Both the quality of unreacted resin in cured foam and the content of unreacted carboxyl, hydroxyl, and isocyanate functional groups are reduced significantly. The process has been used successfully in foaming radomes, as a filler for glass-reinforced plastic wings, and as a source material for dimensionally stable, pre-cured, foamed slabs.



880-ton Multiple Opening Platen Press (HydroLectric). This precision press is designed for polishing and laminating plastic sheets. Complete unit includes a 10-opening press, 20-opening loading and unloading elevator, two-pressure pumping unit and an automatic pressure and temperature control system which permits a wide variation of operating cycles. Write for catalog and engineering information on this and other R. D. Wood Hydraulic Presses for the plastics industry—without obligation.

You'll like what it does to production

It's just plain common sense—when your down-time decreases your production is bound to increase. Down-time can't be eliminated, but R. D. Wood Presses hold it to a minimum. The sound design, choice materials and careful craftsmanship that go into a Wood Press produce a superior product—a dependable, smooth-working press that can't help but increase production records. Write for our catalog and engineering information—no obligation.



R. D. WOOD COMPANY

PUBLIC LEDGER BUILDING • PHILADELPHIA 5, PENNSYLVANIA

Abstracts of Important Articles

Materials

"Block Polymers," N. G. Gaylord, *SPE J.*, 14, 1, 31 (Jan. 1958).

A discussion of addition copolymers initiated by free radicals, growing chain radicals, activation, rupture of polymer chains under shear, and polyfunctional initiators and chain transfer agents; coupling of addition polymers; polyaddition copolymers; and polycondensation copolymers made by copolymerization and interchange reactions, and the coupling of condensation polymers.

"Higher Density Polyethylenes," G. H. Sollenberger, *SPE J.*, 14, 1, 23 (Jan. 1958).

A brief discussion of 0.941-0.965 density polyethylenes, with mention of their stiffness modulus, tensile strength, heat resistance, impact strength, moldability, and environmental crack resistance. Mention is made of fields of application for filaments, coated paper, blown items, sheets, pipe, wire, and injection moldings.

"Polyurethane Resins," W. Abbotson and R. B. Waters, *Plastics Inst.* Trans., 25, 60, 95 (April 1957.)

After briefly mentioning the preparation and reactions of isocyanates, the author considers the production, density, compressive strength, water absorption, aging, behaviour in heat, and chemical resistance of rigid polyurethane foams. Finally, the use of polyurethane for potting and for coating fabrics is described.

"Rigid PVC Development," L. H. P. Weldon, *Plastics Inst. Trans.*, 24, 58, 303 (Oct. 1956.)

The development of rigid PVC in America and Europe is reviewed; and the different methods of processing and fabricating the material, important properties, and the effect of adding small quantities of ester plasticizer on impact strength are discussed. Applications, chiefly in water piping and long-playing records, are described.

"Developments in Polystyrene," R. H. Whitfield, *Plastics Inst., Trans.*, 25, 60, 108 (April 1957.)

Development of polystyrene has proceeded in two main directions: firstly, the improvement of modification of its properties; and secondly, to present it in new physical forms. Under the first heading, the author discusses: formulations to improve moldability, light stability, heat resistance, to render polystyrene antistatic; copolymerization with acrylonitrile to increase chemical resistance; the production of tough and super-tough compounds; and methods of reducing flammability. Under the second heading, he deals with injection molding powders, extruded monofilaments, film and sheet, and expanded polystyrene.

"An Interpretation of Friction in Plastics," J. Calvo Gomez, *Revista Plasticos*, 8, 45, 141 (May-June 1957.)

The author reviews the general phenomena, laws, and theories of friction, in particular the theory that friction results chiefly from a "cold soldering" of the contacting surfaces under load, and a modification of this theory by which a further factor is the "meshing" or fitting into each other, of the surface unevennesses. He considers the characteristics of friction in nylon, polyethylene, and polytetrafluoroethylene; and gives static and dynamic coefficients of friction of steel/polymer, polymer/steel, and polymer/polymer combinations (in Spanish.)

"The Resistance of Glass Fiber Reinforced Laminates to Weathering," L. Gilman, *SPE J.*, 13, 11, 33 (Nov. 1957).

A report on three-year exposure tests with glass-reinforced laminates made with polyester, epoxy, and silicone resins.

"Aromatic Amines as Curing Agents," W. Bandaruk, *Plastics World*, 15, 11, 6 (Nov. 1957).

A brief review of aromatic amine curing agents for epoxy-base adhesives.

In the reference system used, the first number following the magazine name is the volume number, the second is the issue number (if any), and the third is the first page on which the abstracted article appears in that magazine.

Request for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. A complete listing of the publishers and addresses of these magazines is printed here quarterly.

The next complete listing will appear in March.

Protection against loss of color, loss of tensile strength and embrittlement are vital to your successful marketing of vinyl products. You know this!

But, perhaps you do not know the complete story of Metasap Vinyl Stabilizers — designed specifically to assure you relief from the effects of heat and light.

Whether you are producing film, sheeting, floor tile or plastisols there's a Metasap Stabilizer to do the job . . . better. Send for free factual folder today.

METASAP CHEMICAL CO.
HARRISON, NEW JERSEY
A NOPCO Subsidiary

Chicago, Ill. • Boston, Mass.
Cedartown, Ga. • Richmond, Calif.
London, Canada

METASAP CHEMICAL CO.
Harrison, N. J.

Gentlemen: Kindly send me your booklet "Metasap Vinyl Stabilizers".

NAME_____

FIRM_____

ADDRESS_____

CITY_____ STATE_____

"Injection Molding Machines with Screw Plasticization." H. Beck, *Kunststoffe*, 47, 8, 469 (Aug. 1957.)

The thermal processing taking place in the classic material cylinder are discussed, and the variations in cylinder design and the use of pre-plasticizing units as measures to overcome thermal difficulties are considered. The difficulties are claimed to be avoided when an injection screw serves as the injection plunger. The principle of such a system is explained and illustrated by results obtained with the new machine constructed by Ankerwerk, Nurnberg. Presented at the 7th German Plastics Convention, April 1957. (In German.)

"Truprocess Castings for Plastics Dies," A. Torry, *Plastics Inst. Trans.*, 25, 60, 125 (April 1957.)

A series of refinements in steel making and the use of the Shaw Process of investment molding are covered by the name "Truprocess" adopted by an English firm for its method of making dies for casting non-ferrous metals and for making components from rubber, glass and synthetic resins. After discussing the Shaw process and the merits of the ethyl silicate binder for the investment slurry, the author describes the procedure for making a child's hotwater bottle in the shape of a doll as a typical example of Truprocess methods.

RONA
TRADE MARK

PEARL ESSENCE
and
Pearlescent Pigments

• SYNTHETIC PEARL PIGMENTS to meet the most rigid specifications . . . heat stable, chemically resistant and non-corrosive.

• NATURAL PEARL ESSENCE derived from fish scale guanine of the highest quality, to provide maximum luster, brilliance and coverage.

A PRODUCT FOR EVERY TYPE OF PLASTIC

Constant research and development offer you the very best pearlescent pigments on the market. Many completely new products have been developed over the past year. Chemical laboratory control coupled with extensive production facilities assure you of uniform high quality at a remarkably low cost.

RONA LABORATORIES, INC.
East 21st and East 22nd Sts.
Bayonne 7, N. J.
Manufacturers of Pearl Essence exclusively
Plants: Maine • New Jersey • Canada

"Plant for the Extrusion of Pipe and Sheet," H. Reifenhauser,, *Plastics Inst. Trans.*, 24, 58, 346 (Oct. 1956.)

Complicated mathematics have been avoided in this paper presented by a representative of A. Reifenhauser, German machinery manufacturers. The important parts of a pipe-making unit and of a sheet extrusion plant are described. Mention is made of the possibility of continuous sheet production with simultaneous automatic vacuum-forming.

"Linear Polyethylene—Applications, Design and Potential," Vernon Hill and D. A. Jones, *Western Plastics*, 4, 11, 26 (Nov. 1957).

A brief discussion of linear polyethylene in relation to other density types, and its potentials in such application types as toys, containers, and housewares.

"New Physical Testing Methods for Plastics," J. Koppelmann, *Kunststoffe*, 47, 8, 416 (Aug. 1957).

Dynamic tests are particularly suitable for determining the relation of physical properties of plastics in relation to strain time. The author discusses the principles of various methods, including the forced vibration method to determine E-modulus and shear modulus, and the application of supersonics. Dynamic dielectric measurements also are considered, and mechanical- and dielectric-relaxation phenomena are compared. Relatively small stresses and strains, hence simple linear elastic relations, have been dealt with mainly. As an example of the trend to combine several different physical measuring methods for determining non-linear elastic relations, the author mentions apparatus developed by Muller and Engelter for automatically and simultaneously registering the stress-strain diagram of a plastic film and the thermal effects taking place in the film. This paper was presented at the 7th German Plastics Conference. (In German.)

"Thermal Reactions during the Processing of Thermosetting Molding Powders," C. M. von Meysenbug, *Kunststoffe*, 47, 8, 482 (Aug. 1957).

Investigations initiated by the Plastics Technology Committee of the Association of German Engineers, and carried out at the Technical Institute of Darmstadt, aimed at clarifying the thermal reactions occurring during the processing of plastics are discussed. Specific heat, thermal conductivity, dielectric loss factor, and dielectric constant, in relation to temperature, were studied. The methods used, including some specially developed for the purpose, are described, and the practical significance of results is explained. This paper was presented at the 7th German Plastics Conference. (In German.)

"Quantitative Paper Chromatography in the Analytical Chemistry of Phenoplastics," S. Hudecek and D. Beranova, *Plaste u. Kautschuk*, 4, 3, 88 (March 1957).

The procedure followed for the quantitative determination of free phenols in two Novolak resins by the aid of paper chromatography is described. The results of the gests, carried out at the Research Institute for Resins and Lacquers at Pardubice, Czechoslovakia, are said to have represented the actual free phenol contents of the two resoles. (In German.)

"Natural and Accelerated Weathering Tests on Vinyl Plastics," F. Chevassus, *Ind. Plastiques Mod.*, 9, 7, 38 (July-Aug. 1957).

The different factors involved in natural and artificial aging of vinyl compounds are reviewed, with special attention to the effect of light. A number of tests are discussed, reference being made mainly to American sources, but also to British and French investigations. The correlation between natural and accelerated aging tests is examined, and it is emphasized that the latter must be considered only as temporary bases of evaluation to be completed by natural aging tests whenever possible. (In French.)

"Fatigue Tests on Fiberglass Reinforced Plastics," H. Hagen, *Kunststoffe*, 47, 7, 359 (July 1957).

The application of high polymers, especially as construction elements, often is made difficult, if not impossible, because of cold flow under constant load. In order to be able to utilize the special properties of fiberglass-reinforced plastics for construction purposes, it is necessary to know how they behave under prolonged static and dynamic stresses. The author reports testing methods to obtain such data that have been developed by investigators in America and Europe. There are 70 references. (In German.)

"Methods of Producing Foamed Materials, with Special Reference to Blowing Agents," H. A. Scheurlen, *Kunststoffe*, 47, 8, 446 (Aug. 1957).

The importance of blowing agents in the production of foamed products is outlined in a survey of methods in use today. The blowing agents especially considered are azo compounds, N-nitroso compounds, sulfohydrazides, and azides. Their use in PVC and polyethylene is described, together with the factors influencing their decomposition. There are 58 references. (In German.)

"New Types of Polyethylene," M. A. Achon, J. L. Mateo and M. I. Garcia-Banon, *Revista Plasticos*, 8, 45, 132 (May-June 1957).

The chemistry of I.C.I. high-pressure, Ziegler, and Phillips polyethylenes is explained, and the resulting differences in properties compared and discussed. The possibilities for the production of low-pressure polyethylene in Spain are noted briefly. (In Spanish.)

"The Extrusion Characteristics of Polyethylene," D. Grant, *Rubber & Plastics Age*, 38, 4, 328 (April 1957).

The screw of a single-screw extruder can be said to comprise feed, compression, and discharge or metering sections with each performing specific functions. These functions and how the characteristics of polymers influence performance and the quality of the final product are considered, using polyethylene wire-covering and pipe extrusion as examples. In connection with the properties of polyethylene pipe, the limits included in the British Standard Specifications for such pipe are discussed and their importance explained.

"An Appraisal of the Izod Impact Test for Plastics," C. E. Stephenson, *Brit. Plastics*, 30, 3, 99 (March 1957).

As a result of observations over the course of several years that specimens from the same test set tested on different machines, or on the same machine at different times, could give widely different results, detailed tests with the Izod pendulum-type testing apparatus were carried out on cast polymethyl methacrylate sheet to determine the factors involved. A number of factors were found to influence values obtained, and it also could be shown that as a control test, the B.S. test method is preferable to the more reproducible ASTM test. The former discriminates more on the basis of resistance to crack initiation, which usually is of more practical importance. To put the Izod test on a better basis, the requirements are a machine of specified performance throughout its life, the reduction of present limits of specimen size in the specification, and the more precise specification of specimen preparation method and arrangement so that the preparation of notches can be compared.

"Graft Reactions with Peroxides," G. Smets, *Ind. Plastiques Mod.*, 9, 4, 43, & 9, 5, 52 (April & May 1957).

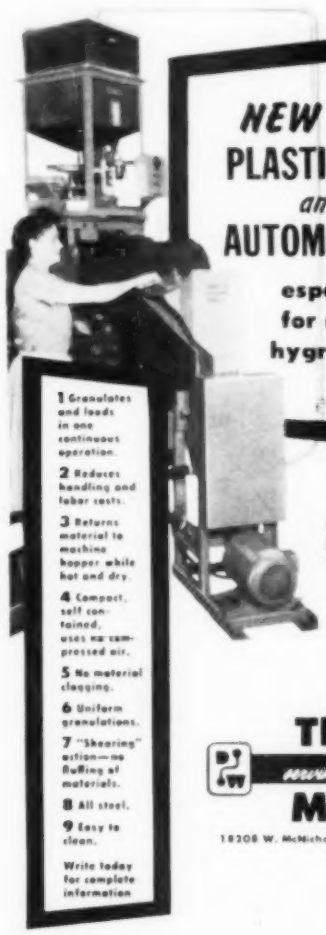
The progress that has been made in producing graft polymers is reviewed. Graft reactions brought about by chain transfer methods (as grafting vinyl acetate onto methyl methacrylate), the addition of monomer to double bonds present in the polymer, and the photochemical decomposition of labile groups are described and compared with various techniques in which peroxides are employed to produce block and graft polymers. (In French.)

"Polymerization of 3,3 bis (fluoromethyl) oxetane," Y. Etienne, *Ind. Plastiques Mod.*, 9, 6, 37 (June 1957).

Experiments were carried out to determine the effect of substituting fluorine atoms for chlorine atoms in bis (chloromethyl) oxetane, from which Imperial Chemical Industries and the Hercules Powder Company have developed polybis (chloromethyl) oxatanes. Bis (fluoromethyl) oxetane was prepared from the chlorinated derivative by refluxing, followed by distillation with glycol on excess anhydrous potassium fluoride, then redistillation with steam, and rectification in presence of calcium hydride. This epoxide was polymerized in solution in anhydrous methyl chloride at the refluxing temperature of the solvent in the presence of 1-4% of etherate of boron fluoride. The resulting polymer is stable, fibrous, microcrystalline, and has a fushion temperature of 135° C. as determined by differential thermal analysis. Its properties are fairly similar to those of poly-bis (chloromethyl) oxabutane, the chief characteristics being very high crystallinity and good resistance to chemicals. (In French)

"Effect of Various Monomers on the Properties of Unsaturated Polyester Resins," E. Behnke, *Kunststoff-Rundschau*, 4, 5, 185 (May 1957.)

After stating reasons for agreeing with the viewpoint that the unsaturated ester component of the unsaturated polyesters must be regarded as a monomer which can react with other monomers to form copolymers, the writer discusses the requirements that monomers must satisfy in order to serve for the production of unsaturated polyester resins. A special table lists 21 monomers that can be so used (most of these have been tested by the writer), and the effect of each one is described briefly. (In German.)



NEW "SHEARWAY"
PLASTICS GRANULATOR
and Combination
AUTOMATIC JET LOADER
especially designed
for nylon and other
hygroscopic materials

1 Granulates and loads in one continuous operation.
2 Reduces handling and labor costs.
3 Returns material to machine hopper while hot and dry.
4 Compact, self contained, uses no compressed air.
5 No material clogging.
6 Uniform granulations.
7 "Shearing" action—no fluffing of materials.
8 All steel.
9 Easy to clean.

Write today for complete information

ALSO AVAILABLE as "alongside press" GRANULATOR with BIN and CASTERS without loading feature.

THORESON-
serving the Plastics Industry
McCOSH, Inc.
18208 W. McNichols • Detroit 19, Michigan • KEnwood 1-8877

Surface
PYROMETERS
for every purpose

The routine use of CAMBRIDGE Surface Pyrometers takes the guesswork out of temperature determination in many industries. The CAMBRIDGE is accurate, dependable, rugged, quick-acting and easy to use. The Roll Model is for checking surface temperatures of still or moving rolls. The Needle Model is for insertion into materials in a plastic or semi-plastic state for within-the-mass temperature determination. The Mold Model is for checking surface temperatures of mold cavities and surfaces of almost any contour.

Send for Bulletin 194SA.

CAMBRIDGE INSTRUMENT CO., INC.
3534 Grand Central Terminal
New York 17, N. Y.

CAMBRIDGE
PIONEER MANUFACTURERS OF
PRECISION INSTRUMENTS

Moisture Indicators and Recorders • Physical Testing Instruments
Surface Pyrometers • Laboratory Instruments for A. C. & D. C. • Galvanometers
Engineering Instruments • Gas Analysis Equipment • Physiological Instruments
and many other Mechanical and Electrical Instruments

Equipment

"A Machine for Cutting Moltoprene," F. Mancini, *Materie Plastiche*, 23, 4, 255 (April 1957)

Introductory remarks on German machines for cutting Moltoprene and an Italian welding machine are followed by a description of a cutting machine designed by Alkett, of Berlin. Production of mattresses by cementing together two profiled sheets of Moltoprene, using a center of flexible Moltoprene with natural, sponge-type pores, also is considered. (In Italian.)

"An Introduction to Injection Molding Equipment," M. G. Munns, Rubber & Plastics Age, 38, 6, 529 (June 1957.)

The basic features of injection molding machines are described including mold-locking system, size of platen, die height, shot and plasticizing capacity, heating chamber design, temperature control system, and injection pressure and speed. Modern control systems, power operation, pre-plasticizing units, material drying, and weigh-feed units also are considered.

"Thermocouple Location and Watt Density in Injection Molding Heating Chambers," R. Dahl and R. McKee, *SPE J.*, 13, 11, 42 (Nov. 1957.)

This 1957 SPE Conference paper describes a test program conducted by Dow Chemical Co. on various injection machines to determine the importance of thermocouple location and watt density.

"Machinery Maintenance," J. G. Thompson, *SPE J.*, 13, 11, 39 (Nov. 1957).

A short discussion of proper maintenance and the use of safety devices.

"Combination Vacuum- and Heat-Forming Machines," E. Escales, *Kunststoffe*, 47, 9, 543 (Sept. 1957).

Description of Formvac U-5, an automatic thermoform machine which permits four operations (deep-drawing, drape-forming, air-slip molding, and drop-form molding) or combinations of two methods. Large, double-walled parts (refrigerator linings molded in one piece with outer walls, for instance) can be made with the machine. A description also is given of Formpack R-7, a machine designed for automatic mass-production of containers of different shapes. Both machines are built by Hydrochemie A. G., Zurich, Switzerland. (In German.)

"Construction and Mode of Action of an Oscillation Viscosimeter," J. Jacobs, Plaste u. Kautschuk, 4, 4, 124; 4, 5, 169 (April & May 1957.)

With this device, viscosity is determined electronically from the damping of a freely-oscillating nickel bar that dips into the fluid to be examined, and from the density of the liquid. Determination of viscosity is rapid, and at the same time, viscosity can be checked continuously, thus permitting automatic regulation of processes. The principle of the method, the construction and action of the apparatus, the movements and frictional forces in the fluid, and the mathematics and mechanical theory of the oscillating bar are treated in detail. (In German.)

Processing

"Cementing Polystyrene Parts: Caution in Using Toxic Solvents," *Kunststoffe*, 47, 9, 560 (Sept. 1957).

The dangers presented to workers by the use of benzene and solvents with high-benzene content in bonding polystyrene parts are described, together with the precautions that should be taken even when the far less toxic toluene and xylene solvents are used. (In German.)

"Electronic Welding of Polyamides," R. Valin, *Plastiques Informations*, 8, 160, 1, (June 16, 1957).

A general discussion of the problems of electronic welding of polyamides precedes a description of a new scale now being designed to facilitate the finding of data on the properties of plastics, necessary for determining welding conditions. When a slide on the scale is moved in the appropriate directions, the average values for the principal properties of a number of insulating materials, at certain temperatures and frequencies, are revealed. (In French.)

"Conditions for Processing Thermoplastic High Polymers in Screw Extruders," K. Tanner, Kunststoffe, 47, 8, 440 (Aug. 1957.)

In plasticizing thermoplastics, the problems to be considered are proper heat transfer, pressure, temperature, and viscosity. Plasticization by frictional heat and by convection are discussed in connection with heat transfer, and it is concluded that the latter offers advantages. Investigations of the relationships of pressure, temperature, and viscosity suggested the regulation of pressure with due consideration of the effect of temperature on viscosity. This and other findings have been taken into consideration in the design of a screw extruder that permits the processing of all extrusion thermoplastics in one and the same machine without changing the screw. This paper was presented at the Seventh German Plastics Convention in April 1957. (In German.)

"Whirl Sintering—Development and New Knowledge," E. Gemmer, *Kunststoffe*, 47, 8, 510, (Aug. 1957.)

Practically any material that will stand the necessary heat can be coated with plastic by the whirl sinter process. In addition to the high-pressure polyethylenes and polyacrylates first used in this process, low-pressure polyethylene and polyamides (Rilsan and ipsilon-caprolactam products) now also are employed. Combinations of thermosetting plastics and colored layers are possible. New apparatus for lining articles like casks and pipe by whirl sintering have been designed, and special equipment for even more intricate applications are being developed. This paper was presented at the Seventh German Plastics Convention in April 1957. (In German.)

"Post Forming Decorative Laminates," L. Stefanind, *Materie Plastische*, 23, 4, 263 (April 1957).

The steps in post-forming laminates with melamine-based decorative surfaces are examined briefly, and hints are given for successful operation. (In Italian.)

"Reinforced Polyester Dies for Deep Drawing of Metallic Sheets," M. Lenzini, *Materie Plastische*, 23, 4, 266 (April 1957).

Description of the methods of making positive and negative dies of reinforced Polyester resin for deep-drawing metal sheets. (In Italian.)

"The Matched Metal Die Molding of Chopped Glass Fibers and Polyester Resins," C. Joseph, *Plastics* (London), 22, 238, 282 (July 1957).

The factors that make for success or failure in the matched metal-die molding technique for making glass fiber-reinforced plastic parts are reviewed. In turn are considered the tools, resins, release agents, application of resins, curing cycles, and the determination of cure.

Applications

"Roplasto, New Roll-up Shutters," P. Parducci, *Materie Plastische*, 23, 4, 251 (April 1957).

Description of the new roll-up shutters made of rigid PVC that were designed and patented by Montecatini under the name, Roplasto. (In Italian.)

"Welded Polyethylene Support Bracket," W. G. C. Backinsell, *Brit. Plastics*, 30, 7, 302 (July 1957).

Description of the preliminary tests and fabrication of a welded polyethylene support bracket especially designed for use by the Royal Aircraft Establishment to support aircraft research models on the end of a mast.

"Plastics in Anti-Corrosion Protection," W. Hermeling, *Plaste u. Kautschuk*, 4, 4, 152 (April 1957).

Present-day use of plastics to protect apparatus and piping in the chemical in-

dustries against corrosion is reviewed. Lining with PVC, coating with phenolic baking enamels and finishes, flame-spraying with PVC and polyamides, and whirl-sintering are discussed, with special reference to practice in East Germany. (In German.)

"Polyester/Glass Radar Reflector," E. J. Seymour, *Brit. Plastics*, 30, 6, 214 (June 1957).

A new surveillance radar is fitted with a scanner that uses a reflector molded from glass-reinforced polyester resin. The reflector, roughly 17 feet long and seven feet across the center, has double curvature and is of sandwich construction. The construction of the mold and the manufacture of the first experimental molding are described.

General

"Results of International Technical and Scientific Collaboration in the Plastics Field," R. Nitsche, *Kunststoffe*, 47, 8, 424 (Aug. 1957.)

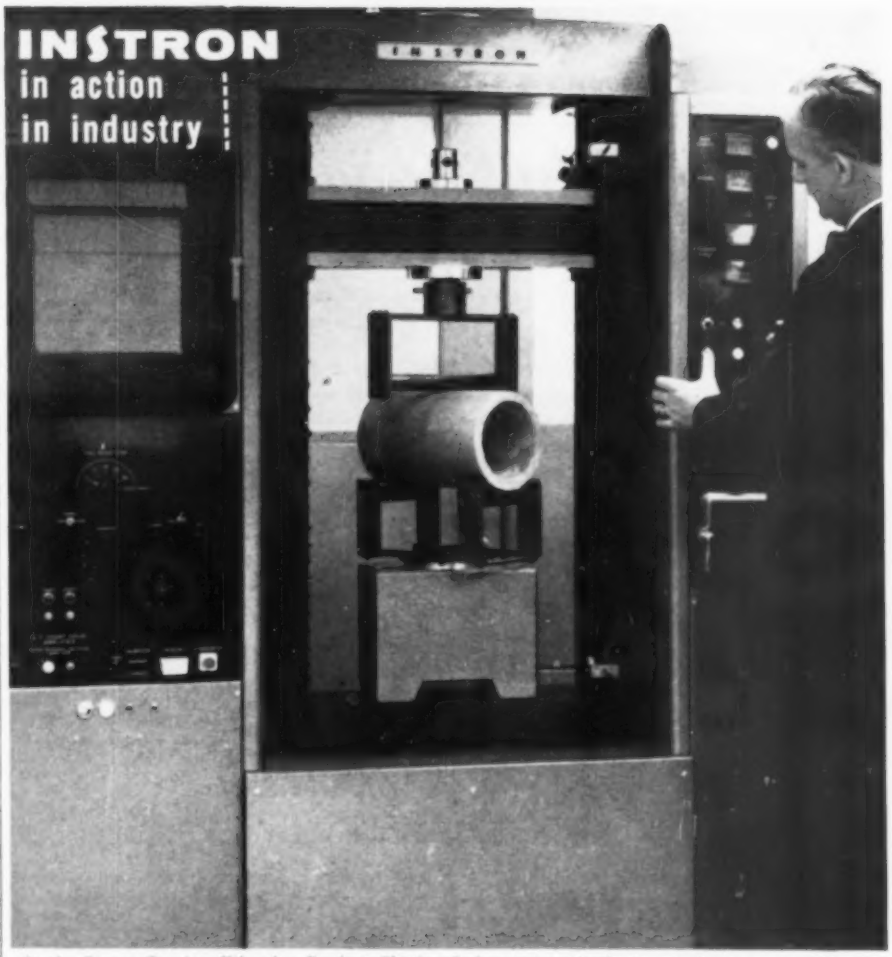
The historical development in international collaboration in the plastics field, and the interrelations between technical, scientific, economic, and political organizations, are reviewed in this paper that was presented at the Seventh German Plastics Convention in April 1957. The value and significance of the work are illustrated by suitable examples. (In German.)

"High Molecular Weight Polyethylenes," M. Feld, *Rubber & Plastics Age*, 38, 3, 251 (March 1957).

Costs and properties of polyethylene produced by the Ziegler method are compared with those for conventional polyethylene. The advantages of the former for certain applications, as well as its limitations, are considered. It is suggested that the name "polymethylene," sometimes applied to it, should be used generally to avoid misleading those without wide technical experience.

"Vestolit S, a Suspension PVC," G. Wick and H. Kpnig, *Kunststoffe*, 47, 6, 299 (June 1957).

Vestolit S is a versatile suspension PVC developed by Chemische Werke Hnls to supplement emulsion-type PVC, after 20 years still the chief type used in Germany. A special polymerization process makes it possible to obtain Vestolit S with any K-value desired; thus opening up new fields of application for the material. Polymers with K-values between 70 and 80 are suitable for processing with plasticizers; those with K-values between 50 and 65 are processed without plasticizers and offer interesting possibilities for the manufacture of rigid pipe, sheet and film. (In German.)



At the Owens-Corning Fiberglas Product Testing Laboratories, the Instron performs a strength test on Fiberglas Prefabricated Duct (a highly efficient air-conditioning air transfer product) to compare its crushing strength with that of old-type metal ducts.

How Owens-Corning Fiberglas Uses the INSTRON TESTER

Owens-Corning Fiberglas Corporation utilizes the Instron for testing problems ranging from the tensile strength of a single glass fiber (3 microns in diameter) to the compressive strength of structural type insulating boards requiring several thousand pounds loading force.

Instron's record of performance in leading laboratories like this is your best assurance that — whatever your field, or your materials testing problem — this most modern of physical test equipment can help you solve it better and more efficiently.

Discover for yourself how much *more* the electronically controlled Instron can do for you on all types of materials. Write for the complete facts booklet today.

The Instron comes in various models and sizes, to suit the widest applications — for tests under all sorts of environmental conditions — with load ranges from 2 grams full scale to 10,000 lbs. **ILLUSTRATED: TABLE MODEL.**

INSTRON
ENGINEERING CORPORATION
2501 Washington Street, Canton, Massachusetts

Patent Digest

Materials

Preparation of Acrylonitrile. No. 2,798,-882. George L. Christopher, New Canaan, and Erwin L. Carpenter, Stamford, Conn., and Marshall L. Spector, Ballston Lake, N. Y. (American Cyanamid Co., New York, N. Y.).

Formation of acetaldehyde and vinyl halide is eliminated and by-product vinyl acetylene is minimized in the preparation of acrylonitrile by the catalytic reaction of HCN and acetylene, by conducting the reaction in the presence of an anhydrous catalyst solution comprising cuprous bromide and a saturated amide solvent.

Improvements in the Production of High Linear Polyesters. No. 2,799,664. James Gordon Napier Drewitt, Spondon, and James Lincoln, London, England. (to British Celanese Ltd.).

A process for the manufacture of a high linear polyester which comprises mixing a free dicarboxylic acid and a cyclic alkylene glycol, with a molten low-linear polyester in sufficient proportion to effect a shortening of the reaction time of the acid and the carbonate. The resulting mixture is heated until a reaction product of intrinsic viscosity 0.1-0.4 has been formed. Application of heat is continued until the material is fiber-forming.

Thermal Modification of Acrylonitrile Polymers. No. 2,799,915. Irvin Barnett and Stanley E. Zager, Somerville, N. J. (to Johns-Manville Corp., New York, N. Y.).

Acrylonitrile in filamentary form is coated with an aqueous dispersion of silica aggregates to leave a discontinuous film of silica solids to minimize its shrinkage during thermal modification. The filament is then heated to a temperature greater than 300° F., but less than its depolymerization temperature, to form a substantially non-thermoplastic material having improved thermal stability and contains at least 60% by weight of non-ignitible mass.

Process for Treating Polyethylene Structures and Articles Resulting Therefrom. No. 2,801,446. Leon E. Wolinski, Buffalo, N. Y. (to E. I. du Pont de Nemours & Co, Wilmington, Del).

The structures are exposed to ozone at a temperature of at least 150° C., quenched in an aqueous conditioning agent, and neutralized in an aqueous alkaline bath.

Polyvinyl Acetate Powder and Process of Making Same. No. 2,800,463. George O. Morrison, Milltown, N. J. (to Shawinigan Resins Corp., Springfield, Mass.).

The powder is composed of particles having a diameter up to five microns and contains unsintered particles of the emulsifying agent used in the emulsion from which it was derived. It is redispersible on being mixed with water.

Addition of Acid to Halt Polyurethane Producing Reaction. No. 2,800,464. Alfred L. Miller, Roselle, N. J. (to Celanese Corp. of America, New York, N. Y.).

A polyurethane producing polymerization reaction between a polyamine and a bis-chloroformate is stopped before 95% of the total theoretical yield of the polymer has been formed by the addition of an acid.

Method of Removing Olefin Polymer From Process Equipment. No. 2,801,234. George E. Hanson, Bartlesville, Okla. (to Phillips Petroleum Co., Bartlesville, Okla.).

A solvent consisting essentially of branched chain paraffin hydrocarbons is boiled in the equipment at temperatures from 350-600° F.

Acrylonitrile Polymer Pastes. No. 2,801,982. Otto Fuchs, Frankfurt am Main Hochst, Germany. (to Farbwerke Hoechst A. G. vormals Meister Lucius und Bruning, Frankfurt am Main Hochst, Germany.).

A paste containing at least 85% polymerized acrylonitrile dissolved in anhydrous hydrogen fluoride.

Odor Inhibited Polyethylene. No. 2,801,225. James Harding, Greenbrook Township, Somerset County, N. J. (to Union Carbide Corp., New York, N.Y.).

An odor stabilized, pigmented, polyethylene composition, comprising a normally solid ethylene polymer, a metal atom-containing pigment, and a 2,4,6-trialkyl substituted monohydric phenol.

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Price, 25c each.
—The Editor

Epoxy Resin Compositions Cured With Metallic Salts of Enol-Keto Tautomeric Compounds. No. 2,801,228. Hans Starck and Felix Schlenker, Wiesbaden, Germany. (to Chemische Werke, Albert, Wiesbaden-Kastel, Germany.).

An epoxy resin composition derived by the reaction of a polyhydroxy phenol with a compound selected from the group consisting of dichlorohydrine and epichlorohydrine; and a hardener consisting of an enol-keto tautomeric compound.

Preparation of Polyfluorocarboxylic Acids and Amides from 1,1-Difluoro-1-Alkenes, Alkali Metal Cyanides and Water. No. 2,802,028. David C. England, Wilmington, Del. (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

Water and an alkali metal cyanide are reacted with 1,1-difluoro-alkene having from 2-14 carbon atoms, and halogen of atomic number 9-17. At least one halogen atom is attached with the carbon atom in the 2-position.

Method of Preparing a Polyurethane. No. 2,802,022. Stephen J. Groszos, Darien, and Erhart K. Drechsel, Springdale, Conn. (to American Cyanamid Co., New York, N. Y.).

Urea and at least one hydroxy carbamate are reacted together.

Copolymer of Ethylenesulfonyl Flouride and Acrylonitrile. No. 2,801,991. Ross M. Hedrick, Dayton, O. (to Monsanto Chemical Co., St. Louis, Mo.).

The copolymer contains from 5-50% of the fluoride, with the balance being acrylonitrile.

Soluble Copolymers. No. 2,817,651. Earl C. Chapin, Springfield, and Richard F. Smith, Ludlow, Mass. (to Monsanto Chemical Co., St. Louis, Mo.)

An organic solvent-soluble binary copolymer of an unsaturated alcohol and an acrylic ester.

Reaction of Polyvinylphthalimides and Alkylene Polyamines and Products Thereof. No. 2,817,645. Cyrus A. Weisgerber, Chadds Ford, Pa. (to Hercules Powder Co., Wilmington, Del.).

A polymer of an N-vinylimide of a dicarboxylic acid is reacted in contact with an alkylene polyamine at a temperature between 100-300° C.

Condensation Polymer Filament. No. 2,793,283. Eugene E. Magat, Wilmington, Del., and Donald R. Strachan, Martinsville, Va. (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

A condensation polymer filament having the structure of a collapsed tube the walls of which are less than 0.00020-inch thick.

Manufacture of Viscose. No. 2,787,615. William Reginald Weighan, Coventry, England. (to Courtalds, Ltd., London, England).

A method of producing viscose suitable for the manufacture of regenerated cellulose products in which cellulose xanthate and a dilute caustic soda solution are mixed in a container at a temperature higher than a predetermined temperature to be used in a subsequent aging step. The viscose is caused to flow continuously in a thin sheet through a vacuum under conditions which permit the boiling off of the bubbles formed in the mixing step. Latent heat of vaporization thus removed cools the viscose, after which it is stored in a container and aged.

Ternary Polymers of Acrylonitrile, a 2-Alkenyl Dihydroxyalkanyl Ether, and Either an Alkyl Acrylate or a Vinyl Pyridine. No. 2,798,864. Walter M. Thomas, Springdale, Conn. (to American Cyanamid Co., New York, N. Y.).

A mixture of copolymerizable ingredients including acrylonitrile, a 2-alkenyldihydroxyalkanyl ether, and a compound of alkyl acrylates and vinylpyridines are combined in a polymerization product to form a ternary polymer.

Cellular Plastic Materials Which Are Condensation Products of Hydroxy Containing Fatty Acid Glycerides and Arylene Diisocyanates. No. 2,787,601. Stanley R. Detrick, Wilmington, and Eric Barthel, Jr., New Castle, Del. (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

A cellular plastic material comprising the condensation product of an arylene diisocyanate and a fatty acid triglyceride having a hydroxyl number not materially less than 49. The composition is reacted with water to provide about one mol of water to every two unreacted isocyanate groups in the condensation mass.

Equipment

Extruding Apparatus. No. 2,791,803. Geodge E. Henning, Baltimore, Md. (to Western Electric Co., Inc., New York, N. Y.).

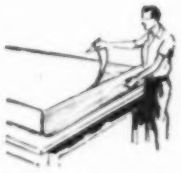
In a standard wire-coating extruder, the improvement consists of a stationary straining element positioned adjacent the extrusion head in the path of the plastic compound. A rotating core tube, mounted adjacent to the forward end of the extrusion screw, supports the straining element against the longitudinal thrust of the plastic compound.

Extrusion Head Assembly. No. 2,794,-213. Benjamin H. Davis, Noank, Conn. (to The Standard Machinery Co., Mystic, Conn.).

The apparatus comprises a head having

Do you have a film casting RELEASE PROBLEM?

Patapar releases almost like magic



As a molding liner for polyurethane foam, Patapar does not "pit" the surface.

Excellent separator and core cover for rubber tape.

In the manufacture of polyester Fiberglas sheets, Patapar imparts satin-like finish.

Excellent as an interliner for cast films and "pre-impregs."

Cast adhesives, plastics and organosols release smoothly and easily from Patapar Releasing Parchments. Patapar will not absorb any of the cast material, and will give the released surface a smooth appearance.

Features include: fiber-free texture; high resistance to penetration or migration of oil and softeners; inertness to any surfaces they contact; permanent releasing action; rigidity or flexibility as desired; easily printable.

RECOMMENDED FOR:

Protective backing for pressure sensitive surfaces... Interleaver for pre-impregnated polyester Fiberglas ... Release backing for tacky shoe soles... Inner ply for multiwall bags for shipping tacky substances... Separator for uncured Neoprene... Release backing for gaskets and rubber caulking... Interleaver and core wrapper for rubber tapes... Casting sheet for organic adhesives, organosols and alkyd films... Interleaver for slab rubber... Casting sheet for polyurethane foams.

Samples and technical assistance freely available. Write us on your business letterhead.

Patapar®
RELEASING PARCHMENT

OTHER PATERSON PRODUCTS
•PATAX
•DURAPAK
•PATERSON
•PARCHKIN

PATERSON PARCHMENT PAPER COMPANY
Bristol, Pennsylvania
Sales Offices: New York, Chicago
West Coast Plant: Sunnyvale, California

HEADQUARTERS FOR VEGETABLE PARCHMENT SINCE 1885

a longitudinal aperture; an extrusion die in one end of the aperture; a core tube in line with the die which defines a tubular communication within the aperture; and means in the tubular passage for defining a helical path which, in part, is of less depth than the passage to permit part of the extrusion stock to flow axially of the latter.

Apparatus for Trimming Molded Articles. No. 2,795,849. Alcide Saint-Andre, Romans, France.

The device consists of a rotary blade system; a high-speed driving means; and a casing. Two independent parts, separated by a radial slot of adjustable breadth, form a counterblade the inner outline of which is arcuate and forms part of a circle tangent to that described by the rotating blades. The point of tangency coincides with the slot which is adapted to be engaged by the burrs.

Filtering Device for Use in the Spinning of Synthetic Linear Polymers. No. 2,792,-122. Werner Muench, Cesano Maderno, and Luigi Notarbartolo, Milan, Italy. (to Perfogit Societa per Azioni, Milan, Italy.).

A spinning filter comprising a casing having an inlet for the liquid polymer to be filtered, and an outlet for the filtrate. A plurality of metal plates are assembled within the casing coaxially with, and perpendicularly to, the general axis of the filter. Their opposite faces are in juxtaposition, and are sufficiently smooth to effect a seal against the liquid polymer when in contact with each other. The plates have through-bores which serve to connect concentric circular grooves on the flat side of the plate-face. A locking means is provided to hold the plates in this relationship, thus providing staggered paths of flow from the inlet to the outlet of the filter.

Means for Fabricating Hollow Articles From Organic Plastic Materials. No. 2,-792,593. Wallace C. Hardgrove, Jr., Freeport, N. Y.

The apparatus comprises a base which carries a rotatably mounted carriage; a vertically-mounted hollow mandrel; an oven, so arranged, that upon rotation of the carriage the mandrel passes through it; and at least one mold located at the oven-exit. The mold is arranged to enclose the mandrel and is provided with separating mechanism. A means is provided on the interior of the so-enclosed mandrel to hold pressurized fluid.

Processing

Plasticized Nuclear Alkylphenol-Formaldehyde Resins and Paper Laminates Prepared Therefrom. No. 2,817,386. George Counos, Springfield, Mass. (to Monsanto Chemical Co., St. Louis, Mo.).

A plurality of paper sheets are impregnated and bonded with a plasticized resin consisting essentially of a binary condensation product of a nuclear alkylphenol and formaldehyde. The resin is cured in situ, to an insoluble, infusible state, forming a paper laminate.

Pearlescent Polystyrene. No. 2,817,118. James William Lynn Fordham, Hazardville, Conn. (to Monsanto Chemical Co., St. Louis, Mo.).

A polymer composition comprising isobutylene, isoprene, and monomeric styrene is injection molded at a temperature of 150-300° C., a ram pressure of 500-1,000 psi., to form a pearlescent polystyrene article.

Reinforced Sheet Material. No. 2,787,-570. de Forest Lott and Edward G. Hamway, Toledo, O. (to General Tire & Rubber Co., Akron, O.).

A pliable sheet material comprising interwoven nylon and glass fibers. A film of plasticized resin is adhesively joined to the reinforcing web through its interstices. The resin is selected from the group consisting of polyvinyl chloride, copolymers of vinyl chloride and vinyl acetate, and polyvinylidene chloride.

Method of Making Plastic Covered Golf Balls. No. 2,787,024. Robert F. Smith, Elyria, O. (to Worthington Ball Co., Elyria, O.).

A polyethylene plastic material is heated to a temperature greater than 475° F., and injection molded at a high pressure to a selected blank shape. The resulting mass is placed in a die cavity and remolded at reduced pressure and temperature for 2¾ to 3½ minutes, after which the pressure is increased and the mold temperature reduced to set the remolded plastic.

Laminates and Process for the Production Thereof. No. 2,817,618. Robert Hall Hahn, Winchester, Va.

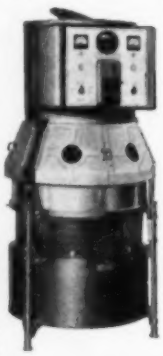
A sheet of thermoplastic resinous material is heated to 300-400. F., and while at an elevated temperature above 275° F., it is treated to impart a modified surface finish. Upon cooling, the unfinished surface of the sheet is pressed against a metal surface preheated to at least 225° F., and bearing an adhesive composition that is activated under these conditions. The combination is cooled to form a metal-plastic laminate.

Applications

Container Bonded With a Polyester-Urethane. No. 2,801,648. John F. Anderson and Leon F. Fiedler, Cuyahoga Falls, O. (to B. F. Goodrich Co., New York, N. Y.).

Your fast way of pre-determining the weathering qualities of a Plastic is in the ATLAS WEATHER-OMETER®

Test for resistance to sunlight, moisture, and thermal shock.
Results are accurate and reliable and can be reproduced precisely over and over again. The Weather-Ometer furnishes a yard stick to measure the improved quality of a plastic in development and to maintain a standard of quality in production.
Automatic control of light, moisture, and temperature, can be set for repeating cycles according to the test program selected. A year of destructive weathering can be reduced to a few weeks of testing in the Weather-Ometer.



For Color Fastness only — use the Atlas Fade-Ometer®. Fully automatic in operation.

Write for technical information and recommendations for your particular problem.

ATLAS ELECTRIC DEVICES CO., 4114 N. Ravenswood Ave., Chicago 13, Illinois

WEATHER-OMETERS® • FADE-OMETERS® • LAUNDER-OMETERS®

Patent Digest (Cont'd.)

An article of manufacture comprising a metal base container having at least one of its seams bonded with a polyester-urethane of one mol of an essentially linear polyester of a polyglycol, and a dibasic aliphatic acid, each containing from 4-10 carbon atoms, and reacted with from 0.9-1.5 mols of an organic diisocyanate.

Plastic Shoe Unit. No. 2,798,312. Frank A. Muller, Philadelphia, Pa.

A molded plastic basic shoe unit comprising a relatively flat shaped forepart tread sole; an arched shank portion; a relatively low, hollow, heel portion; a transverse, relatively low breast extending upward from the front of the heel bottom; an upwardly extending full counter; and a vamp foxing wall adapted to secure vamp upper means to provide a full shoe. The heel well is filled with a relatively light-weight, shock absorbing filler material, and an insole overlies the tread sole, the shank portions and the filler material.

Phonograph Record. No. 2,787,602. Kenneth Deane Groves, Bryn Mawr, Pa. (to American Viscose Corp., Philadelphia, Pa.).

A phonograph record comprising 83% by weight of a copolymer of vinyl chloride and vinyl acetate; 6% by weight of fibrous cotton particles; 6% by weight non-fibrous cellulose acetate; 2% carbon black; and 3 cadmium stearate.

Filters and Filter Material for Use in Filtering Tobacco Smoke. No. 2,792,006. Jan Ivo Mareck, Margate, England.

A filter is made with a cellulosic material in combination with carbon, in a form penetrable by smoke, and of at least 96% purity. The carbon is obtained by a wet process from lignin, heated with concentrated sulphuric acid, and subsequently treated with steam.

Method for Preventing Moisture Condensation on Cold Pipes. No. 2,797,731. Frank A. Carlson, Jr., Springfield, Mass. (to Monsanto Chemical Co., St. Louis, Mo.).

Cold pipe is wrapped with a foamed polystyrene tape having a closed cell structure such that the majority of the cells have a diameter of less than 0.05-inch.

Molded Plastic on Sheet Metal Desk Top. No. 2,793,090. Carl F. Wolters, New Canaan, Conn. (to Sperry Rand Corp., New York, N. Y.)

A desk construction, to whose top a plastic cover is to be molded, includes an elongate slot through which the cover material is flowed. Aligned with the slot, a channel element secured to the undersurface of the top receives the cover material.

Directory

1 time	$16.50 per inch
6 times	$15.40 per inch
12 times	$13.20 per inch

Equip your used injection machine with an IMS Extra Capacity Heating Cylinder. Gain an extra margin of profit—get one jump ahead of your competitor who sticks to old style under-capacity heaters. Prompt delivery.

Don't put it off! Write today and find out how you can upgrade your present press with an IMS Heating Cylinder:

INJECTION MOLDERS SUPPLY CO.
3514 LEE RD.
CLEVELAND 20, OHIO

Positions Open

Classified Rates $10.00 per inch.

SALES REPRESENTATIVE WANTED for eastern U.S. to handle the sales of vinyl plastisols, organosols and solution coatings. Technical background required as well as selling experience.
ADDRESS REPLIES TO:
AUBURN PLASTICS, INC.
CHEMICAL PROCESSING DIVISION
AUBURN, NEW YORK

PLASTICS CHEMISTS AND ENGINEERS

Openings are available in expanding R & D department to provide products applications services to polyethylene sales.

These services will include: evaluations of fabrication techniques, products application evaluations and development, technical service calls to customers, and providing technical information to sales concerning polyethylene fabrication and quality.

Location: National Petro-Chemicals Corp., Tuscola, Ill.

Require chemists, chemical engineers, and plastics engineers with B.S. degree. Applicants with previous thermo-plastics experience preferred.

Submit resumes to Industrial Relations Department.

NATIONAL DISTILLERS AND CHEMICAL CORP.
99 Park Ave. New York, N. Y.

In this plant making plastic printing plates, each press *has its own Speedylectric steam boiler.* Each press is independent of the others, and each gets steam at the right temperature and pressure. There is no big boiler to waste power when only one or two presses are needed, and it takes only minutes to bring a press up to temperature for a rush order.

For every plastic molding operation, a Speedylectric steam generator is the ideal answer. Using the most economical method of generating steam electrically, its design eliminates low-water hazard and practically removes the need for attendance. Maintenance is nil, and there's no risk of fire or explosion. Sizes from 2 to 60 Bhp, 15 to 500 psi and higher. Requires 220, 440, or 550 v A.C. UL listed, ASME Code. For more information write Pantex Mfg. Corp., Box 660AU, Pawtucket 1, Rhode Island.

In Brief . . .

Lurie Plastics, Inc., is the new name of the reorganized Dominion Plastics Co., which continues in the previous offices and plant in Colonial Heights, Va. The company has discontinued the manufacture of sheet plastics and vacuum forming, and is confining its activities to custom injection molding. G. B. Finney has been appointed president and general manager, and J. W. Coleman and R. R. Ellis have been named sales manager and chief engineer, respectively.

Lucidol Division, Wallace & Tiernan, Inc., Buffalo, N. Y., is marketing its Lupersol DDM, a methyl-ethyl ketone peroxide solution used as a low-temperature catalyst for polyester resins, in five-gallon, 40-pound JaLiner Containers. The JaLiner is a seven-pound steel drum with a polyethylene liner and a built-in, flexible pouring spout. These single-trip containers replace the bulky, breakable glass carboys formerly used, save carboy deposits, and reduce the storage problems for the company and its customers.

Alpha Plastics, Inc., Livingston, N. J., has reduced the list prices for its Schedule 40, 80, and 120 rigid PVC pipe by 16.%.

Plastics Laboratory, Princeton University, Princeton, N. J., is offering plastics program fellowships in graduate engineering study and fundamental research in plastics leading to the degree of Master of Science in Engineering. Fellowships with stipends of $1,500-2,100 plus tuition and fees are available. Opportunities for employment as half-time Research Assistants at $2,100 per academic year also are available to students not on fellowships. Complete information can be obtained by writing to Prof. L. F. Rahm, director of the Laboratory.

Barrett Division, Allied Chemical & Dye Corp., New York, N. Y., has appointed Moreland Chemical Co., Inc., Spartanburg, S. C., as southern representative for its Plaskon Nylon molding compounds, covering Florida, Georgia, the Carolinas, Virginia, and Eastern Tennessee. Moreland also maintains branches in Charlotte, N. C., and Greenville, S. C.

Bel-Art Products, West New York, N. J., has purchased Dubonnet Products. The acquisition permits Bel-Art, a pioneer in the fabrication of polyethylene and other thermoplastics, to round out its services with the new Dubonnet Acetate Division, and the formation of a new vacuum forming department. The entire staff of Dubonnet continues with Bel-Art.

Dow Chemical Co., Midland, Mich., has changed the name of Styrex 767 to Tyril 767. The new name allows Dow to establish a completely separate identity for the Tyril family of plastics. These products, styrene-acrylonitrile copolymers, differ basically in formulation from Dow's other plastic families. A clear or opaque thermoplastic, Tyril 767 is a molding material that is expected to find greatest application in the manufacture of quality dinnerware, industrial components, and a variety of other products requiring a high degree of toughness, tensile strength, and chemical resistance.

Formica Corp., Cincinnati, O., has added district sales offices in Houston, Tex., and San Diego, Calif., under the managerships of Bob Hockaday and Bob Welch, respectively. Houston had formerly been part of the firm's Dallas district, while San Diego had been connected with the Los Angeles office. The Houston office will cover Southern Texas to the New Mexico border, while the San Diego office will cover Arizona, San Diego proper, and Imperial County in California.

Union Carbide Chemicals Co., Division of Union Carbide Corp., New York, N. Y., has moved its New Orleans, La., district sales office to 4833 Conti St.

CADET CHEMICAL CORPORATION

Lockport-Olcott Road
Burt 4, New York

Manufacturers of ORGANIC PEROXIDES

BENZOYL PEROXIDE
LAUROYL PEROXIDE
MEK PEROXIDE

2, 4 Dichlorobenzoyl Peroxide

Descriptive Literature Available On Request.

Distributed by

CHEMICAL DEPARTMENT

of

McKESSON & ROBBINS, INC.

155 East 44th St., New York 17, N.Y.

Warehouse Stocks in
Principal Cities

CALENDAR of COMING EVENTS

March 5-6
"Plastics in Building Illumination," Plastics Study Group, Building Research Institute, University of Houston, Houston, Tex.

March 11
SPE Baltimore-Washington Section, 14th Annual Technical Forum, Friendship Int'l Airport, Baltimore, Md.

March 27-28
Third Annual Convention, Nat'l Assn. of Store Fixture Manufacturers, Conrad Hilton Hotel, Chicago, Ill.

April 14-15
Ninth Conference on Rubber and Plastics, American Inst. of Electrical Engineers, Sheraton Mayflower Hotel, Akron, O.

April 21-23
Seventh Annual Meeting, Building Research Institute, Shoreham Hotel, Washington, D. C.

May 1-8
26th Annual Convention and Tool Show, American Society of Tool Engineers, Convention Center, Philadelphia, Pa.

June 9-12
1958 Microscopy Symposium, Del Prado Hotel, Chicago, Ill.

June 9-21
Triennial meeting, Intl. Organization for Standardization, Harrogate, England.

June 15-19
Semi-annual meeting, ASME, Hotel Statler, Detroit, Mich.

June 22-27
Annual meeting, ASTM, Hotel Statler, Boston, Mass.

Nov. 17-21
Eighth National Plastics Exposition, Intl. Amphitheatre, Chicago, Ill.

Domestic Production and Sales of Plastics and Resin Material, September and October, 1957

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of September and October, 1957. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

Cellulosics, phenolics, ureas, and styrenes, all registered slight gains as compared with last years figures for this period. Polyethylenes rose 10–20%, while polyesters and coumarone-indene remained about the same.

	September, 1957		October, 1957	
	Production	Sales	Production	Sales
Cellulose Plastics[1]				
Cellulose acetate and mixed ester:				
Sheets, under 0.003 gage	1,716,456	1,741,554	1,346,583	1,568,396
Sheets, 0.003 gage and over	1,693,086	1,579,087	1,638,769	1,739,921
All other sheets, rods, and tubes	776,798	681,079	827,641	713,925
Molding and extrusion materials	9,098,180	8,575,053	9,662,913	9,656,546
Nitrocellulose sheets, rods, and tubes	280,523	292,430	329,656	345,046
Other cellulose plastics	495,424	457,074	546,232	551,876
TOTAL	14,060,469	13,326,277	14,351,794	14,575,710
Phenolic and Other Tar-Acid Resins:				
Molding materials[1]	14,669,119	14,470,718	20,666,580	25,133,080
Bonding and adhesive resins for—				
Laminating (except plywood)	5,224,609	4,192,817	5,475,943	4,887,995
Coated and bonded abrasives	1,335,823	1,532,816	1,488,261	1,850,995
Friction materials (brake linings, clutch facings, and similar materials)[7]				
Thermal insulation (fiber glass, rock wool)	4,411,311	4,638,526	4,707,490	5,257,211
Plywood	4,167,202	3,169,224	3,833,618	3,531,034
All other bonding and adhesive uses	4,752,208	5,202,301	5,824,629	6,040,887
Protective-coating resins, unmodified and modified except by rosin	2,652,924	2,257,161	2,956,656	2,357,528
Resins for all other uses	2,845,547	2,378,104	3,320,708	2,873,475
TOTAL	40,058,743	37,841,667	48,273,885	51,932,205
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	2,648,725	2,686,094	3,143,138	3,248,093
Paper-treating and paper-coating resins	1,867,540	1,897,138	1,704,449	1,866,428
Bonding and adhesive resins for—				
Plywood	8,665,378	8,642,992	9,379,114	8,439,444
All other bonding and adhesive uses, including laminating	2,928,178	2,886,759	3,489,622	3,359,958
Protective-coating resins, straight and modified	2,920,621	2,369,676	3,555,595	2,567,595
Resins for all other uses, including molding	7,376,318	7,747,443	8,217,171	8,754,570
TOTAL	26,406,760	26,230,102	29,489,089	28,236,088
Styrene Resins:				
Molding materials[1]	37,485,161	36,668,940	39,658,802	37,985,768
Protective-coating resins, straight and modified	6,661,105	6,651,007	8,646,506	7,099,652
Resins for all other uses	11,011,029	10,286,154	13,757,877	12,735,183
TOTAL	55,157,295	53,606,101	62,063,185	57,820,603
Vinyl and Vinyl Chloride Resins[3]				
Polyvinyl chloride and copolymer resins (50% or more PVC) for—				
Film (resin content)		9,406,156		10,746,639
Sheeting (resin content)		4,986,609		5,101,700
Molding and extrusion (resin content)		18,653,475		21,712,036
Textile and paper treating and coating (resin content)[2]		6,541,946		6,802,134
Flooring (resin content)		7,155,626		7,506,081
Protective coating (resin content)		2,363,211		2,256,342
All other uses (resin content)		4,189,452		4,466,092
All other vinyl resins for—				
Adhesives (resin content)		3,190,982		3,770,681
All other uses (resin content)		8,770,886		10,886,704
TOTAL	72,237,994	65,258,343	77,087,798	73,248,409
Coumarone-Indene and Petroleum Polymer Resins	21,680,147	21,133,962	23,087,566	22,785,648
Polyester Resins	6,663,599	6,508,103	7,975,507	7,094,706
Polyethylene Resins	60,183,806	53,107,049	62,551,826	66,805,870
Miscellaneous Synthetic Plastics and Resin Materials:				
Molding materials[1], [4]	4,196,592	4,271,698	5,075,028	4,822,323
Protective-coating resins[5]	1,096,193	625,060	1,155,750	609,023
Resins for all other uses[6]	11,677,734	9,544,556	12,605,734	10,662,510
TOTAL	16,970,528	14,441,314	18,836,512	16,093,856
GRAND TOTALS	313,419,381	291,452,918	343,717,162	338,593,075

[1]Includes fillers, plasticizers, and extenders.
[2]Production statistics by uses are not representative, as end use may not be known at time of manufacture.
[3]Includes data for spreader and calendering-type resins.
[4]Includes data for acrylic, nylon, silicone, and other molding materials.
[5]Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins.
[6]Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.
[7]Included with "All other bonding and adhesive uses."
SOURCE: United States Tariff Commission, Chemical Division.

INDEX TO ADVERTISERS*

FEBRUARY, 1958

Atlas Electric Devices Company 184
Agency: Kreicker & Meloan, Incorporated

Buss Machine Works 168
Agency: Stevens, Incorporated

Cadet Chemical Corporation 186

Cambridge Instrument Company, Incorporated 179
Agency: E. M. Freystadt Associates

Celanese Corporation of America 108-9
Chemical Division
Agency: Ellington & Company, Incorporated

Columbian Carbon Company 123
Agency: Donahue & Coe, Incorporated

Diamond Alkali Company 114
Agency: Fuller & Smith & Ross, Incorporated

E. I. Du Pont de Nemours 120
Agency: N. W. Ayer & Son

Eastman Chemical Products, Incorporated
Plastics Division 163
Chemical Division 99
Agency: Fred Wittner Advertising

Emery Industries, Incorporated ..... Fourth Cover
Agency: Erwin, Wasey, Ruthrauff & Ryan Incorporated

The English Mica Company 166
Agency: Terrill Belknap Marsh Associates

Enjay Company, Incorporated 122
Agency: McCann-Erickson

Escambia Chemical Corporation 157
Agency: Godwin Advertising Agency

General Tire & Rubber Company 110
Chemical Division
Agency: D'Arcy Advertising Company

Gering Products, Incorporated 117
Agency: Riedl and Freede, Incorporated

The Glidden Company 115
Chemicals-Pigments-Metals Division
Agency: Meldrum & Fewsmith, Incorporated

W. R. Grace & Company 106-7
Polymer Chemicals Division
Agency: Kelly Nason, Incorporated

Harchem Division, Wallace & Tiernan, Incorporated 167
Agency: Branstater Associates, Incorporated

Improved Machinery 160
Agency: Hillsborough Advertisers

Instron Engineering Corporation 181
Agency: Larcom Randall Advertising, Incorporated

Metasap Chemical Company 177
Agency: Gray & Rogers

Monsanto Chemical Company 112-13
Plastics Division
Agency: Needham, Louis and Brorby, Incorporated

National Lead Company 104
Agency: Marschalk and Pratt

Oronite Chemical Company 118
Agency: L. C. Cole Company, Incorporated

Pantex Manufacturing Corporation 185
Agency: Richard LaFond Advertising, Incorporated

Paterson Parchment Paper Company 183
Agency: Grant & Wadsworth, Incorporated

Phillips Chemical Company 105
Agency: Lambert & Feasley, Incorporated

Pittsburgh Coke & Chemical Company ..... Third Cover
Industrial Chemicals Division
Agency: W. S. Walker Advertising, Incorporated

Plastics Engineering Company 103
Agency: Kuttner & Kuttner, Incorporated

Plating Engineering Company 154

Reichhold Chemicals, Incorporated 121
Agency: MacManus, John & Adams, Incorporated

Rona Laboratories, Incorporated 178
Agency: Byrde, Richard & Pound

Rubber Corporation of America 172
Agency: Ovesey and Straus, Incorporated

Shell Chemical Corporation ..... Second Cover
Agency: J. Walter Thompson Company

Thoreson-McCosh, Incorporated 179
Agency: Norman P. Townsend

U.S. Industrial Chemicals Company
Chemical Division 116
Polyethylene Division 100
Agency: G. M. Basford Company

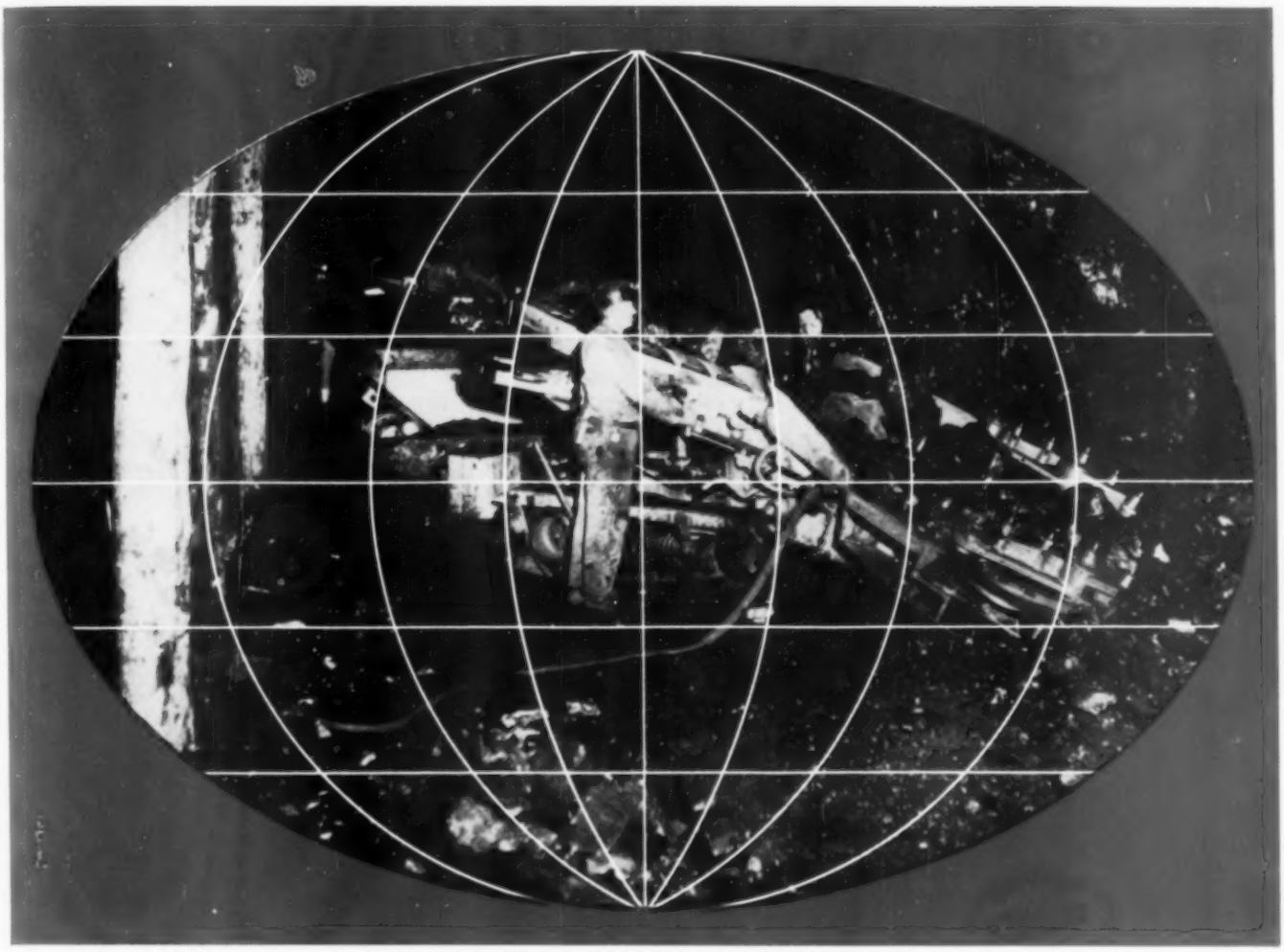
United States Radium Corporation 169
Agency: Molesworth Associates

R. T. Vanderbilt Company, Incorporated 165
Agency: H. Edward Oliver

Welding Engineers, Incorporated 126
Agency: John Miller Advertising Agency

R. D. Wood Company 176
Agency: Harris D. McKinney, Incorporated

*This is published as a service only. Publisher assumes no liability for errors or omissions.



Best Place in the World to Start Making Quality Plasticizers

IF your business is vinyls, you may have more interest than you realize in this coal mine. For the phthalate plasticizers you use aren't too many production steps removed from coal.

At Pittsburgh Coke & Chemical, we control every step of plasticizer production—from coal, through naphthalene and phthalic anhydride production to finished Pittsburgh PX Plasticizers. That's the best way we know to assure you of dependable, uniform quality and continuing, reliable supplies, regardless of marketing conditions.

But maybe we've overlooked the most important benefit our basic position offers you. And that's our view of the *future*—both *your* future and ours. Behind Pittsburgh's constantly growing investment in personnel and production facilities is a vigorous, long-range research program. Objective: To *continue* providing you with *better plasticizers at lower cost.*

Isn't this an important consideration to bear in mind as you plan *your* new and better plastic products of today . . . and *tomorrow?*

WBW 6947

PITTSBURGH *Job-Rated* PLASTICIZERS

COAL CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

PLASTOLEIN® 9720 MAKES VINYL UPHOLSTERY PERFORM BETTER!

Here's the permanent, polymeric plasticizer you need to make your vinyl upholstery perform better... by withstanding the abuse of constant use, resisting the deteriorating action of time and the natural elements, yet staying soft and attractive. Plastolein 9720 provides this permanence through its low volatility, resistance to extraction, low migration, and excellent resistance to heat and ultra-violet light.

In addition to such performance features, low-cost Plastolein 9720, even though a polymeric, possesses a relatively low viscosity that provides the processing advantages common to monomerics, and permits the economies of bulk shipping and handling.

With all these advantages to gain, why not try Plastolein 9720 in your vinyl upholstery—or in any formulation where extreme permanence is essential.

For complete details on 9720 or any of the Plastolein Plasticizers, mail coupon below.

Emery

Organic Chemical Sales Department

Emery Industries, Inc., Carew Tower, Cincinnati 2, Ohio

Emery Industries, Inc.
Dept. Q-2 Carew Tower, Cincinnati 2, Ohio

Please send 32 page Emeryfacts describing all the Plastolein Plasticizers.

Name_____ Title_____

Company_____

Address_____

City_____ State_____